Precision Cooling
For Business-Critical Continuity

Liebert Deluxe System/3™ - DX

Installation Manual - 50 and 60 Hz, 6-30 Ton DX Systems (DH/DE/VH/VE)

Liebert®

EMERSON™
Network Power

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PRODUCT MODEL INFORMATION

Table i Model number designation

DH	245	A	–	A	A	E	I
VH = Upflow DX	Nominal Capacity in Thousand BTU/H	A = Air Cooled	U = 4 Step DX	A = 460/3/60	A = Advanced Micro-processor	0 = No Reheat	0 = No Humidifier
DH = Downflow DX		W = Water Cooled	H = DX with Hot gas Bypass	B = 575/3/60	G = Advanced Graphics Micro-processor	E = Electric Reheat	I = Infrared Humidifier
DE = Downflow DX w/ Econ-O-Coil		G = Glycol Cooled		C = 208/3/60		H = Hot Water Reheat	G = Steam Grid Humidifier
VE = Upflow DX w/ Econ-O-Coil				D = 230/3/60		G = Hot Gas Reheat	S = Steam Generating Humidifier
				F = 380/3/50		T = Steam Reheat	
				G = 415/3/50			
				H = 230/3/50			
				J = 200/3/50			
				M = 380/415/3/50			

WARNING

Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air conditioning equipment. Improper installation could result in property damage, injury or loss of life.

WARNING

Hazardous voltage! Always disconnect power before servicing.

CAUTION

Evaporator unit requires drain connections and may also require water supply. Do not locate directly above any equipment that could sustain water damage.

Equipment Inspection

Upon arrival of the unit, inspect all items for either visible or concealed damage. Damage should be immediately reported to the carrier and a damage claim filed with a copy sent to Liebert or to your sales representative.

Table ii Unit weights

	Capacity and Cooling Type	Weight lbs (kg)
Air Cooled Models DH/VH, 60 (50) Hz	75A	1205 (547)
	114A (115A)	1425 (647)
	125A (130A)	1440 (645)
	199A	1840 (835)
	245A	1960 (890)
	290A	2025 (920)
	380A	2160 (981)
Water Cooled Models DH/VH, 60 (50) Hz	86W	1455 (661)
	127W (128W)	1675 (761)
	138W (143W)	1690 (768)
	219W	2110 (957)
	267W	2280 (1036)
	315W	2345 (1065)
	412W	2500 (1135)
Glycol Cooled Models DH/VH, 60 (50) Hz	72G	1455 (661)
	110G (111G)	1685 (765)
	116G (121G	1700 (772)
	192G	2130 (967)
	240G	2300 (1045)
	265G	2365 (1074)
	363G	2530 (1148)
GLYCOOL Models DE/VE, 60 (50) Hz	72G	1615 (733)
	110G (111G)	1845 (837)
	116G (121G)	1860 (844)
	192G	2385 (1082)
	240G	2555 (1159)
	363G	2750 (1248)

1.0 INTRODUCTION

1.1 System Descriptions

Deluxe System/3 environmental control systems are available in several configurations. Each configuration can operate with either Advanced Microprocessor Controls (AM), or Advanced Microprocessor Controls with Graphics (AG). A brief description of each, including operational differences, can be found below. Check model numbers to see what is supplied with your unit.

1.1.1 Compressorized Two-Step Systems

These systems may be air, water, or glycol cooled, depending on the heat rejection method selected.

Cooling

Two stages of mechanical refrigeration are available.

Heating

Three stages of electric reheat are standard; steam/hot water, hot gas (on water and glycol cooled systems) are optional.

Humidification

Infrared is standard. Steam grid and steam generating humidification are optional.

Dehumidification

These systems utilize the lag compressor.

1.1.2 Compressorized Four-Step Systems

The four-stage systems have all the features of a compressorized, two-stage system plus cylinder unloaders on one head of each compressor. This permits the compressors to operate at a reduced level and increases energy efficiency during low-load conditions. The system responds to an increasing room load with either a two-step or a four-step process of increasing the unit's cooling.

Cooling

These systems have four stages of mechanical refrigeration:

a. Lead compressor at reduced capacity
b. Lead and lag compressors at reduced capacity
c. Lead compressor at full capacity; lag compressor at reduced capacity
d. Lead and lag compressors at full capacity

Heating

Three stages of electric reheat are standard; hot water/steam are optional.

Humidification

Infrared is standard; steam grid and steam generating humidification are optional.

Dehumidification.

These systems utilize the lag compressor.

1.1.3 GLYCOOL™ (Chilled Glycol Cooling) Systems

GLYCOOL systems have all of the features of a compressorized water or glycol system, plus a second cooling coil that is connected into the water circuit. When fluid temperature is sufficiently low (below room temperature), cooling is provided by circulating the fluid through the second cooling coil (flow is controlled by a motorized valve.) This is then the primary cooling source, and it greatly reduces the compressor operation.

Cooling

At lower fluid temperatures, the second cooling coil acts as the main cooling system. The motorized valve opens proportionally to match the room load. At higher fluid temperatures, two or four stages of mechanical refrigeration control the room load.

Heating

Three stages of electric reheat are standard.

Humidification

Infrared is standard; steam generating is optional

Dehumidification

These systems utilize the lag compressor.

1.1.4 Dual Source Cooling Systems

This system has all the features of a compressorized system but adds a second cooling coil that is connected to a source of chilled water. This second coil is controlled by a modulating control valve. It is the primary source of cooling and dehumidification so compressor operation is reduced.

Cooling

The second coil acts as the primary cooling system. A modulating valve opens proportionally in response to the room load. Two and four stages of mechanical refrigeration as a secondary cooling system at higher room loads.

Heating

Three stages of electric reheat are standard.

Humidification

Infrared is standard; steam generating is optional

Dehumidification

These systems utilize the chilled water valve, then the lag compressor if required by the load.

2.0 INSTALLATION

2.1 Room Preparation

The room should be well-insulated and must have a sealed vapor barrier. The vapor barrier in the ceiling can be a polyethylene film type. Use a rubber-base or plastic-base paint on concrete walls and floors. Doors should not be undercut or have grilles in them.

Outside, or fresh, air should be kept to an absolute minimum. Outside air adds to the heating, cooling, humidifying and dehumidifying loads of the site. It is recommended that outside air be kept below 5% of the total air circulated in the room.

2.2 Location Considerations

For a downflow unit, the unit can sit on an accessible, elevated flooring system. It may be necessary to furnish additional pedestal support below the unit to ensure maximum structural support. A separate floor stand for the unit may be used as support, independent of the elevated floor and installed prior to the flooring system.

For downflow and upflow units, provide approximately 34" (864mm) service clearance on the left, right and in front of the unit whenever possible. The minimum space required for installation is 18" (45.7 cm) on the left end, 18" (45.7 cm) on the right end, and 24" (61 cm) in front of the unit. This space is necessary to permit routine maintenance, such as replacing filters, adjusting the fan speed and cleaning the humidifier.

NOTE

If high efficiency 6" filters are used, 25" (63.5 cm) is required on the right end for removal and replacement of filters.

Avoid locating units in an alcove or at the extreme end of a room that has a high aspect ratio (long narrow room). Also avoid locating units too close together. This tends to reduce the effectiveness of the air distribution as compared to units located 30-40 feet (9-12m) apart.

2.3 Unit Dimensions

Figure 1 Downflow (DH and DE models) cabinet and floor planning dimensional data

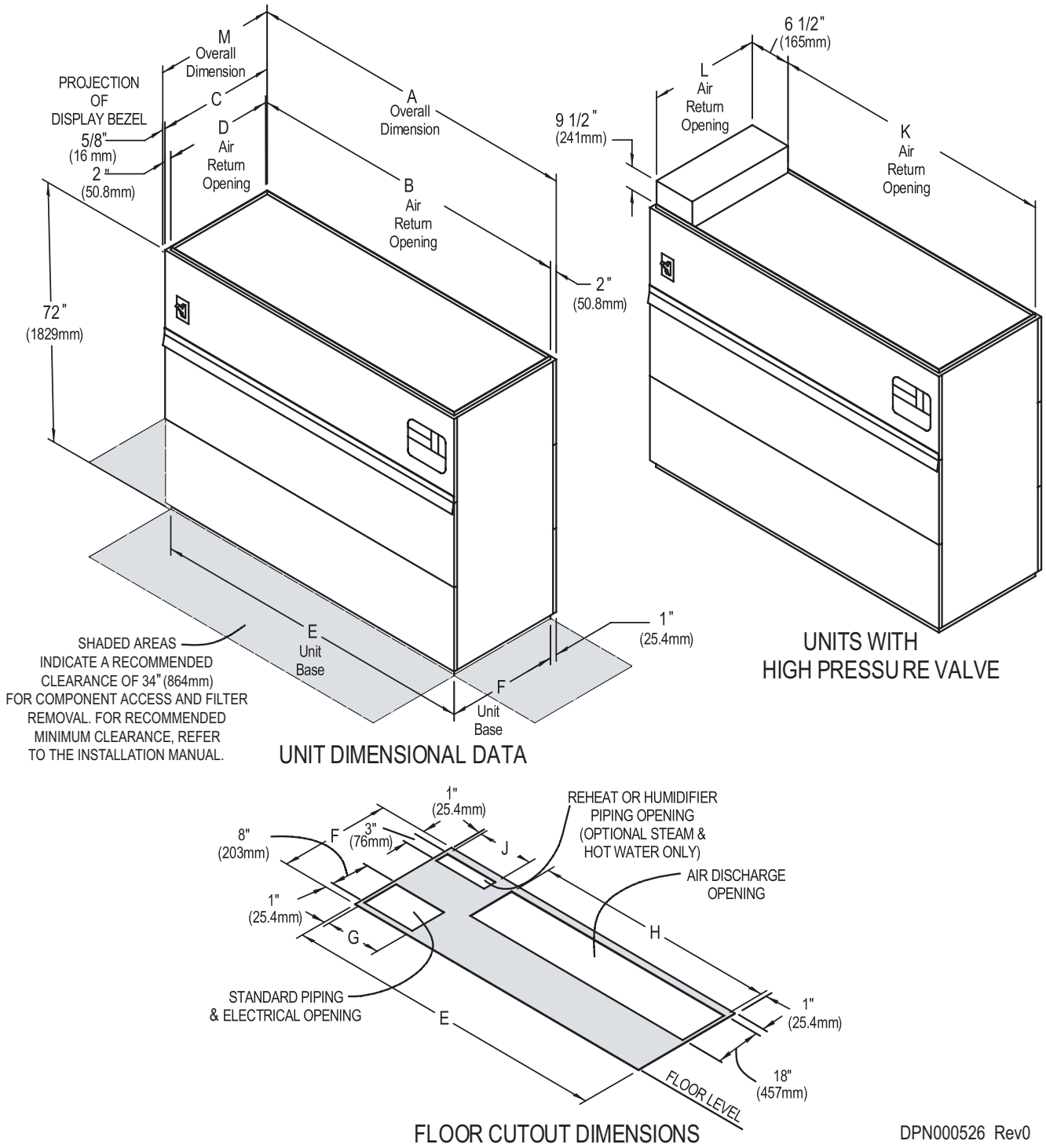


Table 1 Downflow (DH and DE models) dimensions

Air Cooled Water Cooled Glycol Cooled GLYCOOL		Dimensional Data inches (mm)										
60 Hz	**50 Hz**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**
DH75A DH86W DH72G DE72G	DH75A DH86W DH72G DE72G	74 (1880)	70 (1778)	35 (889)	32 (813)	72 (1829)	33 (838)	14-1/4 (362)	54-3/4 (1391)	35-5/8 (905)	63-1/2 1613	27 (686)
DH114A DH127W DH110G DE110G	DH115A DH128W DH111G DE111G	74 (1880)	70 (1778)	35 (889)	32 (813)	72 (1829)	33 (838)	14-1/4 (362)	54-3/4 (1391)	35-5/8 (905)	63-1/2 1613	27 (686)
DH125A DH138W DH116G DE116G	DH130H DH143W DH121G DE121G	74 (1880)	70 (1778)	35 (889)	32 (813)	72 (1829)	33 (838)	14-1/4 (362)	54-3/4 (1391)	35-5/8 (905)	63-1/2 1613	27 (686)
DH199A DH219W DH192G DE192G	DH199A DH219W DH192G DE192G	99 (2515)	95 (2413)	35 (889)	32 (813)	97 (2464)	33 (838)	16-1/4 (413)	77-3/4 (1975)	35-5/8 (905)	88-1/2 (2248)	27 (686)
DH245A DH267W DH240G DE240G	DH245A DH267W DH240G DE240G	99 (2515)	95 (2413)	35 (889)	32 (813)	97 (2464)	33 (838)	16-1/4 (413)	77-3/4 (1975)	35-5/8 (905)	88-1/2 (2248)	27 (686)
DH290A DH315W DH265G	DH290A DH315W DH265G	99 (2515)	99 (2515)	35 (889)	32 (813)	97 (2464)	33 (838)	16-1/4 (413)	77-3/4 (1975)	35-5/8 (905)	--	--
DH380A DH412W DH363G DE363G	DH380A DH412W DH363G DE363G	122 (3098)	118 (2997)	35 (889)	32 (813)	120 (3048)	33 (838)	16-1/4 (413)	100-3/4 (2559)	35-5/8 (905)	111-1/2 (2832)	27 (686)

Figure 2 Upflow 6, 8 and 10 ton (VH and VE models) cabinet and floor planning dimensional data

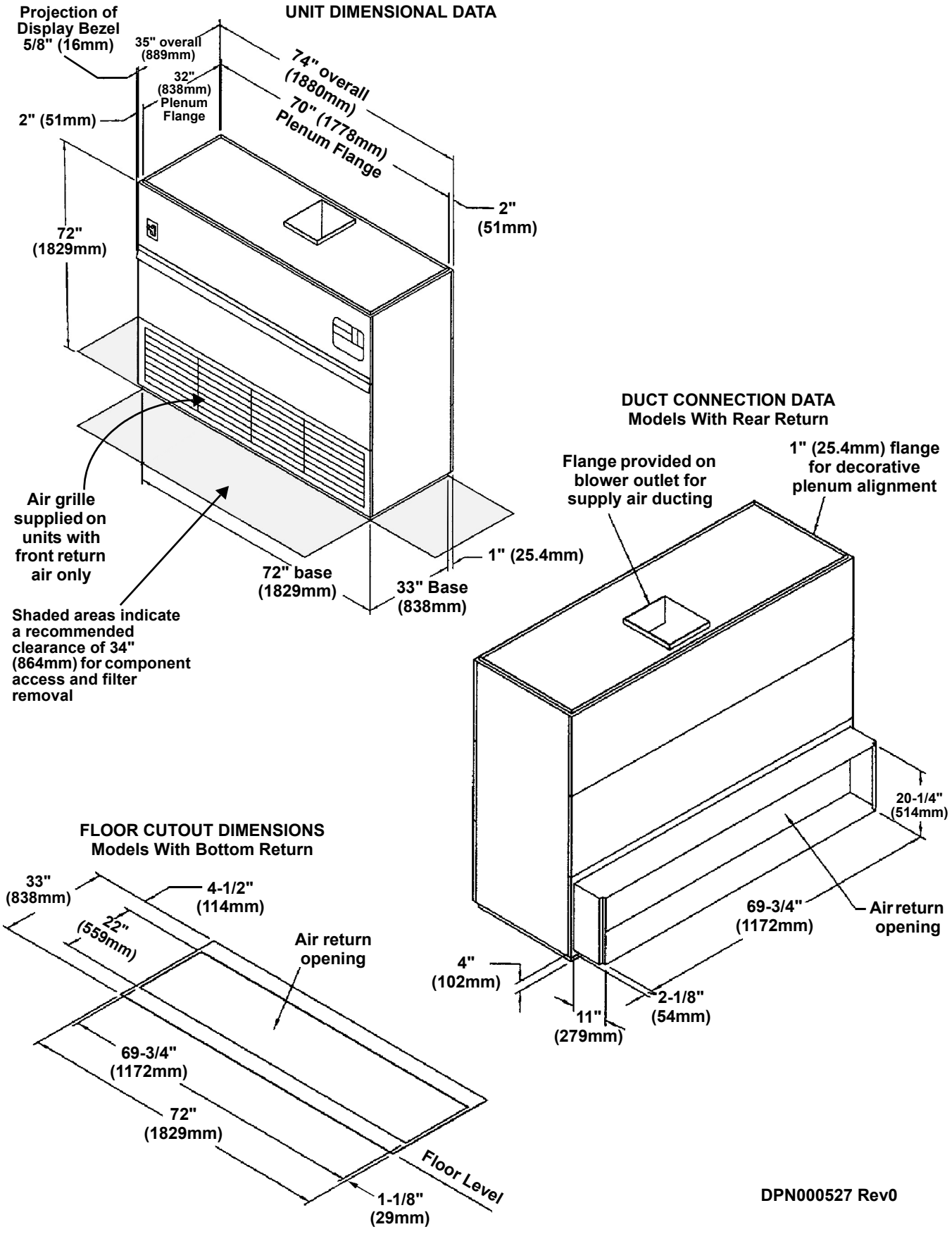


Figure 3 Upflow 6, 8 and 10 ton (VH and VE models) blower duct and deck dimensional data

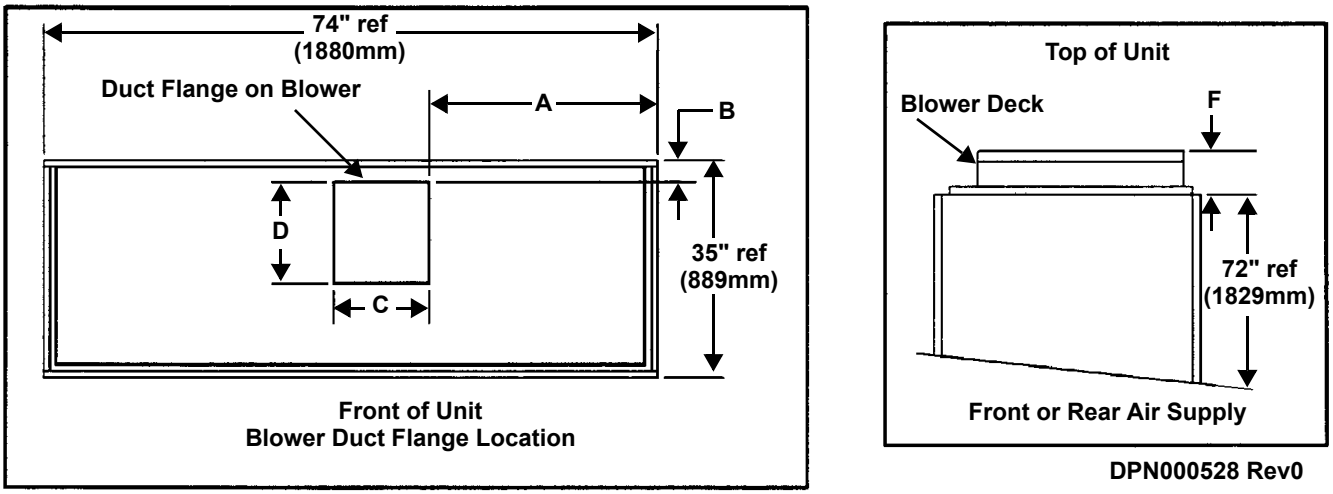


Table 2 Upflow 6, 8 and 10 ton (VH and VE models) blower duct and deck dimensional data

	Blower	Supply	Motor HP	Dimensional Data inches (mm)				
				A	B	C	D	F
VH075A VH086W VH072G VE072G	15 x 15	TOP FRONT	1-5	22-7/8 (581)	3-1/2 (89)	18-13/16 (478)	16-3/16 (411)	1-1/2 (38)
		TOP REAR	1-5	22-7/8 (581)	12-5/16 (313)	18-13/16 (478)	16-3/16 (411)	1-1/2 (38)
	15 x 11	TOP FRONT	1-5	22-7/8 (581)	3-1/2 (89)	14-7/8 (378)	16-3/16 (411)	1-1/2 (38)
		TOP REAR	1-5	22-7/8 (581)	12-5/16 (313)	14-7/8 (378)	16-3/16 (411)	1-1/2 (38)
	12 x 9	TOP FRONT	1-5	22-7/8 (581)	5-7/8 (149)	12-7/16 (316)	13 3/4 (349)	1-1/2 (38)
		TOP REAR	1-5	22-7/8 (581)	12-5/16 (313)	12-7/16 (316)	13 3/4 (349)	1-1/2 (38)
VH115A/VH114A VH128W/VH127W VH111G/VH110G VE111G/VE110G	15 x 15	TOP FRONT	1.5-5	22-7/8 (581)	3-1/2 (89)	18-13/16 (478)	16-3/16 (411)	1-1/2 (38)
		TOP REAR	1.5-5	22-7/8 (581)	12-5/16 (313)	18-13/16 (478)	16-3/16 (411)	1-1/2 (38)
	15 x 11	TOP FRONT	2-7.5	22-7/8 (581)	3-1/2 (89)	14-7/8 (378)	16-3/16 (411)	1-1/2 (38)
		TOP REAR	2-5	22-7/8 (581)	12-5/16 (313)	14-7/8 (378)	16-3/16 (411)	1-1/2 (38)
			7.5					4 1/2 (114)
VH130A/VH125A VH143W/VH138W VH121G/VH116G VE121G/VE116G	15 x 15	TOP FRONT	2-5	22-7/8 (581)	3-1/2 (89)	18-13/16 (478)	16-3/16 (411)	1-1/2 (38)
		TOP REAR	2-5	22-7/8 (581)	12-5/16 (313)	18-13/16 (478)	16-3/16 (411)	1-1/2 (38)
	15 x 11	TOP FRONT	3-10	22-7/8 (581)	3-1/2 (89)	14-7/8 (378)	16-3/16 (411)	1-1/2 (38)
		TOP REAR	3-5	22-7/8 (581)	12-5/16 (313)	14-7/8 (378)	16-3/16 (411)	1-1/2 (38)
			7.5-10	23 7/8 (606)				4 1/2 (114)

Figure 4 Upflow 15, 20 and 22 ton (VH and VE models) cabinet and floor planning dimensional data

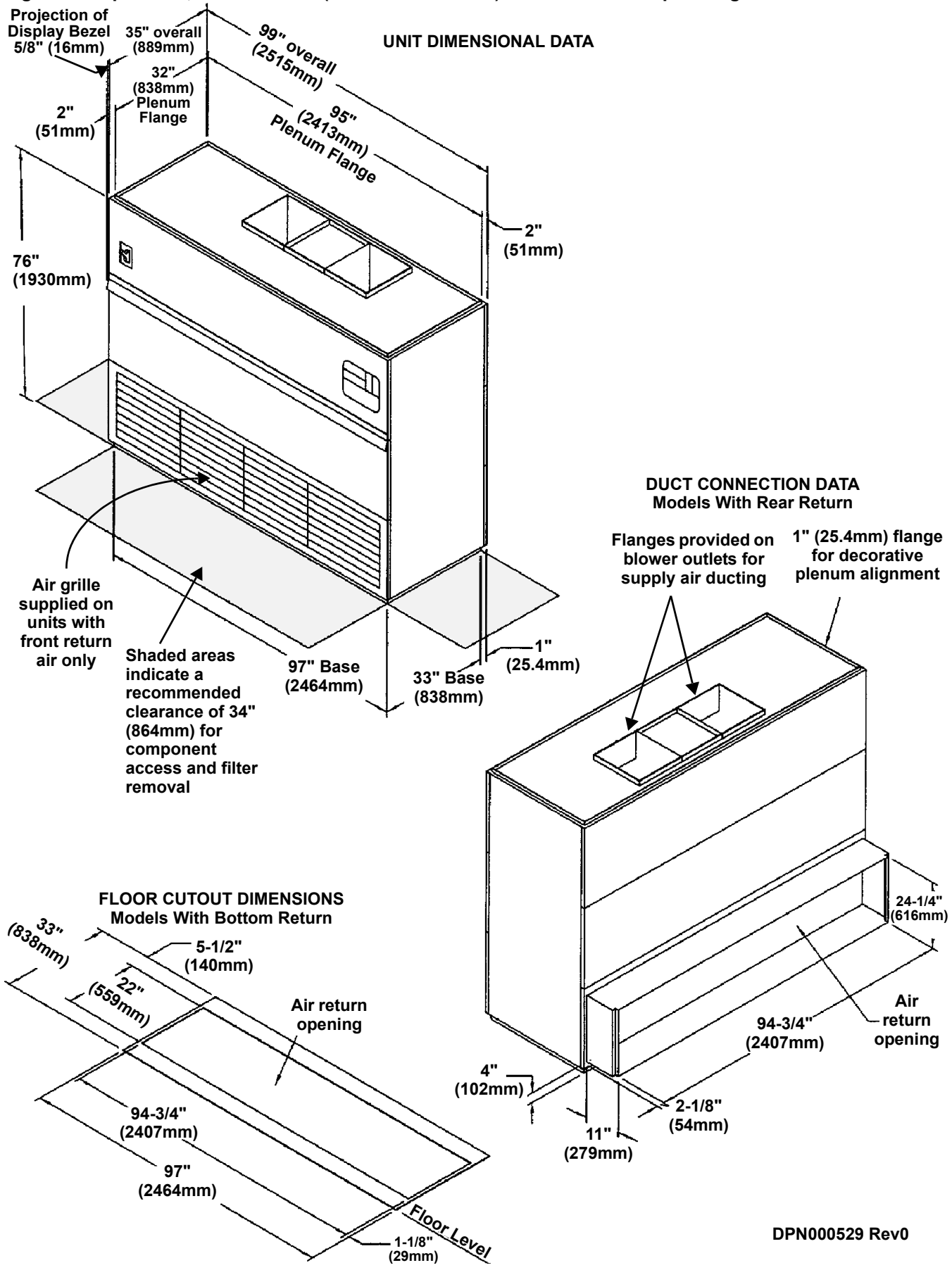
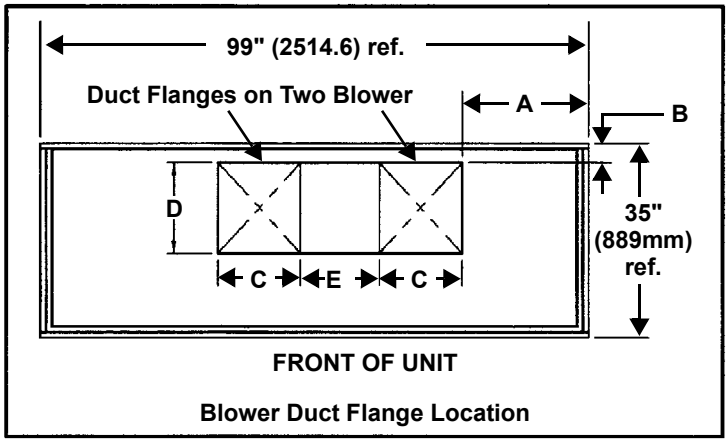


Figure 5 Upflow 15, 20 and 22 ton (VH and VE models) blower duct and deck dimensional data



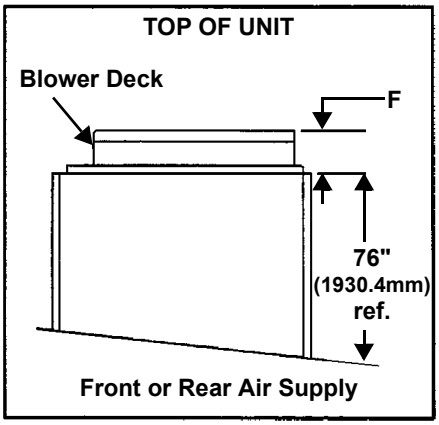


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Table 3 Upflow 15, 20 and 22 ton (VH and VE models) blower duct and deck dimensional data

	Blower	Supply	Motor HP	Dimensional Data inches (mm)					
				A	B	C	D	E	F
VH199A VH219W VH192G VE192G	15 x 15	TOP FRONT	3-7.5	20-3/8 (518)	3-1/2 (89)	18-13/16 (478)	16-3/16 (411)	12-11/16 (322)	1-1/2 (38)
			10	22-7/8 (581)					
		TOP REAR	3-5	20-3/8 (518)	12-5/16 (313)	18-13/16 (478)	16-3/16 (411)	12-11/16 (322)	1-1/2 (38)
			7.5-10	25-3/8 (645)				10 (254)	4-1/2 (114)
	15 x 11	TOP FRONT	5-7.5	20-3/8 (518)	3-1/2 (89)	14-7/8 (378)	16-3/16 (411)	16-5/8 (422)	1-1/2 (38)
			10	22-7/8 (581)					
			15	25-3/8 (645)				14-1/2 (368)	
		TOP REAR	5	20-3/8 (518)	12-5/16 (313)	14-7/8 (378)	16-3/16 (411)	16 5/8 (422)	1-1/2 (38)
			7.5-15	25-3/8 (645)				14 1/2 (368)	4-1/2 (114)
	12 x 9	TOP FRONT	7.5	20-3/8 (518)	5-7/8 (149)	12-7/16 (316)	13-3/4 (349)	22-3/4 (578)	1-1/2 (38)
			10	22-7/8 (581)					
			15	25-3/8 (645)				18-5/8 (473)	
		TOP REAR	7.5-15	25-3/8 (645)	12-5/16 (313)	12-7/16 (316)	13-3/4 (349)	18-5/8 (473)	4-1/2 (114)
VH245A VH290A VH267W VH315W VH240G VH265G VE240G	15 x 15	TOP FRONT	5-7.5	20 3/8 (518)	3-1/2 (89)	18-13/16 (478)	16-3/16 (411)	12-11/16 (322)	1-1/2 (38)
			10	22-7/8 (581)					
		TOP REAR	5	20 3/8 (518)	12-5/16 (313)	18-13/16 (478)	16-3/16 (411)	12-11/16 (322)	1-1/2 (38)
			7.5-10	25 3/8 (645)				10 (254)	4 1/2 (114)
	15 x 11	TOP FRONT	7.5	20 3/8 (518)	3-1/2 (89)	14-7/8 (378)	16-3/16 (411)	16-5/8 (422)	1-1/2 (38)
			10	22-7/8 (581)					
			15	25 3/8 (645)				14-1/2 (368)	
			20	27 7/8 (708)					4 1/2 (114)
		TOP REAR	7.5-15	25 3/8 (645)	12-5/16 (313)	14-7/8 (378)	16-3/16 (411)	14-1/2 (368)	4-1/2(114)
			20	27 7/8 (708)					

Figure 6 Upflow 30 ton (VH and VE models) cabinet and floor planning dimensional data

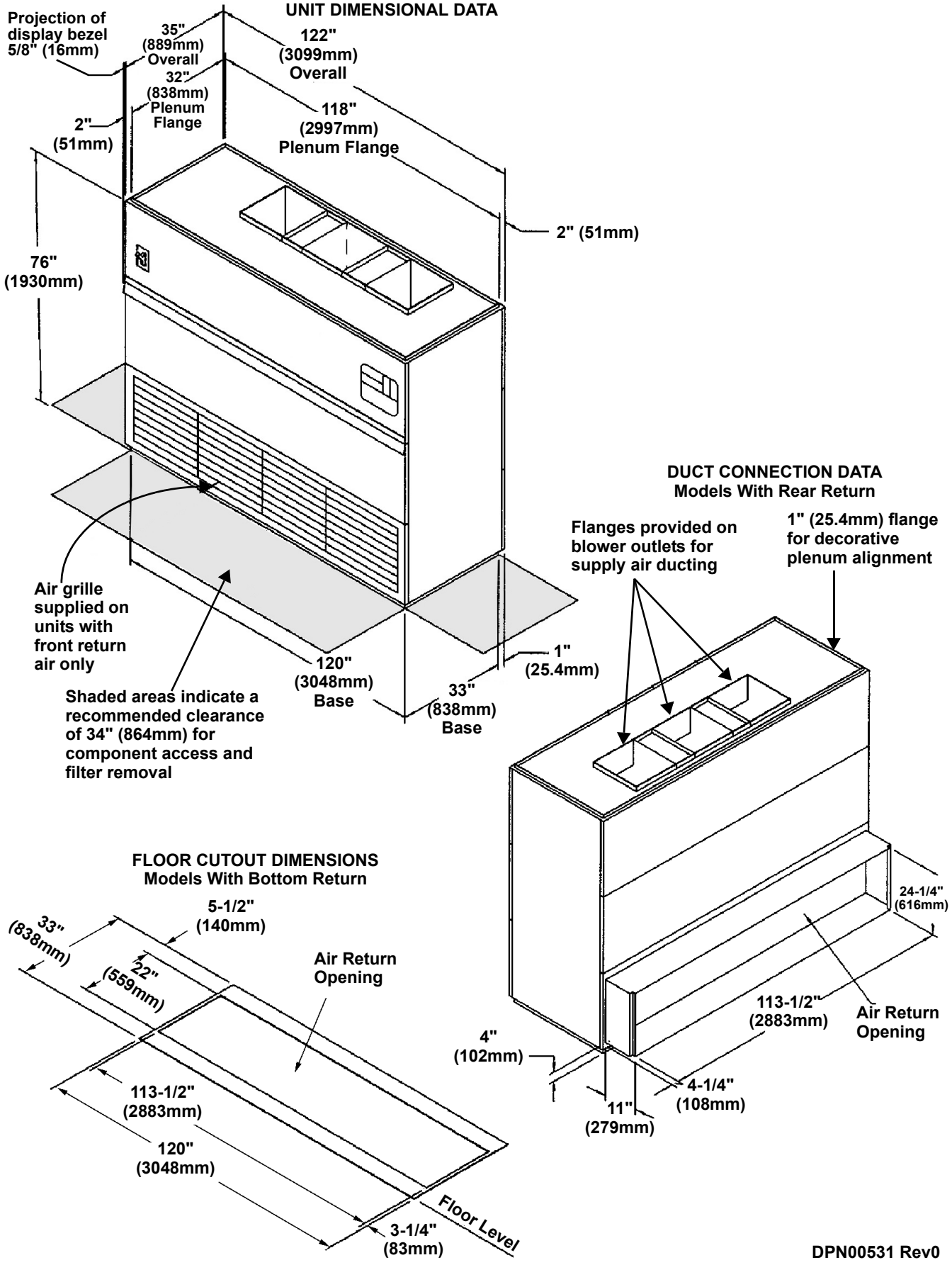

Figure 7 Upflow 30 ton (VH and VE models) blower duct and deck dimensional data

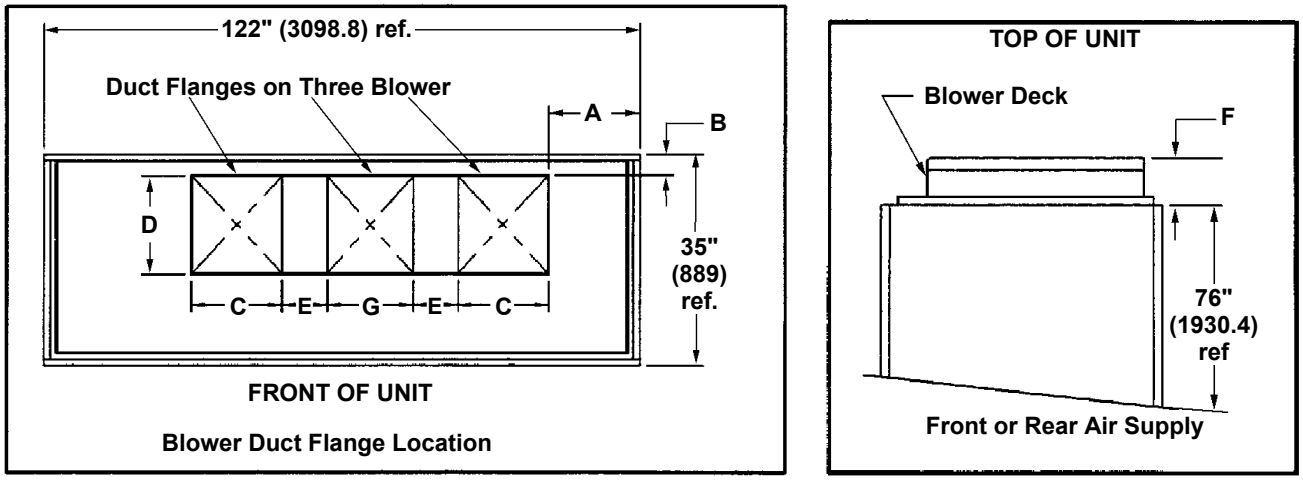

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Table 4 Upflow 15, 20 and 22 ton (VH and VE models) blower duct and deck dimensional data

	Blower	Supply	Motor HP	Dimensional Data inches (mm)						
				A	B	C	D	E	F	G
VH380A VH412W VH363G VE363G	15 x 5	TOP FRONT	10	22-7/8 (581)	3-1/2 (89)	18-13/16 (478)	16-3/16 (411)	10 (254)	1-1/2 (38)	18-5/8 (473)
		TOP REAR	10	22-7/8 (581)	12-5/16 (313)	18-13/16 (478)	16-3/16 (411)	10 (254)	4-1/2 (114)	18 5/8 (473)
	15 x 11	TOP FRONT	10-15	27-7/8 (708)	3-1/2 (89)	14-7/8 (378)	16-3/16 (411)	10 (254)	1-1/2 (38)	14-11/16 (373)
			20						4-1/2 (114)	
		TOP REAR	10-20	27-7/8 (708)	12-5/16 (313)	14-7/8 (378)	16-3/16 (411)	10 (254)	4-1/2 (114)	14-11/16 (373)

2.4 Piping

All fluid and refrigeration connections to the unit, with the exceptions of the condensate drain and live steam, are sweat copper. Factory-installed piping brackets must not be removed. Field-installed piping must be installed in accordance with local codes and must be properly assembled, supported, isolated and insulated. Avoid piping runs through noise-sensitive areas, such as office walls and conference rooms.

Refer to specific text and detailed diagrams in this manual for other unit-specific piping requirements

2.4.1 Drain Line

A 3/4" NPT is provided for the evaporator coil condensate drain. This drain line also drains the humidifier, if applicable. The drain line must be located so it will not be exposed to freezing temperatures. The drain should be at least the full size of the drain connection and pitched a minimum of 1/8" per ft. (11mm per meter).

NOTE

This line may contain boiling water. Use copper or other suitable material for the drain line.

For units without a condensate pump

The unit is shipped from the factory with an internally-mounted trap. No external trap is required. The drain line must comply with all applicable codes.

For units with a factory-installed condensate pump option

The unit is shipped from the factory with a condensate pump installed. The condensate pump discharge (drain) line must comply with all applicable codes.

For units with a field-installed condensate pump

The unit is shipped from the factory with the condensate pump option, unmounted in the unit, which must be installed in the field. The unit has an internally mounted trap. The drain line from the unit to the condensate pump does not require a trap. The discharge (drain) line from the pump must comply with all applicable codes.

2.4.2 Piping Considerations for Raised-Floor Applications

All piping below the elevated floor must be located so that it offers the least resistance to air flow. Careful planning of the piping layout under the raised floor is required to prevent the air flow from being blocked. When installing piping on the subfloor, it is recommended that the pipes be mounted in a horizontal plane rather than stacked one above the other. Whenever possible, the pipes should be run parallel to the air flow.

2.5 Electrical Connections

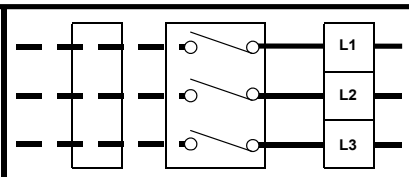
Three-phase electrical service is required for all models in either 208, 230, 460 or 575V, 60Hz; or 200, 230 or 400V, 50 Hz. Electrical service shall conform to national and local electrical codes.

Install a manual electrical disconnect switch within 5 feet (1.6 m) of the unit in accordance with codes. A factory-supplied disconnect switch may be factory-mounted within the unit and accessible from the exterior.

Figure 8 Electrical connection details

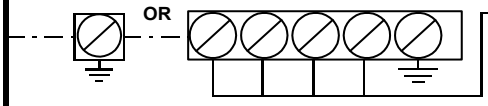
ROOM UNIT CONNECTIONS

3-phase line voltage supply to line voltage connection block or optional main disconnect switch (Note 2)



To line voltage components on Liebert room unit electric panel

Earth ground to ground lug bolt or optional ground bar

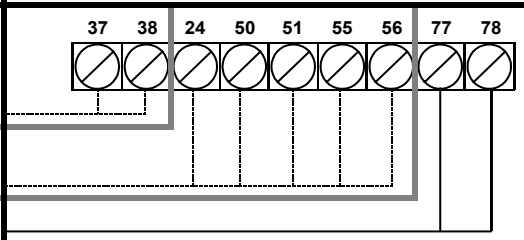


To line voltage components in Liebert room unit

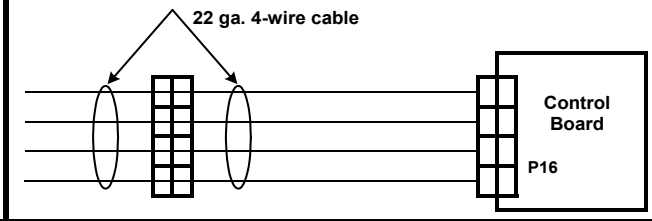
2-wire connection for remote unit shutdown (Note 3)

2-wire connection for each Special Alarm (Note 4)

2-wire connection optional SiteScan

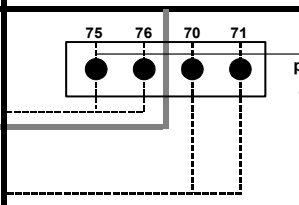


4-pin plug connections for optional remote temperature and humidity sensor



2-wire connection for common alarm

2-wire connection for heat rejection interlock (Note 5)



6-inch pigtails at junction box

Terminals 75 & 76 are connected to common alarm relay (K3) NO contact (max 1A at 24V)

Wires 70 & 71 are connected to compressor side switches and Econ-O-Coil relay (R5). R5 is provided on FE/UE units only.

NOTES

1. **Refer to specification sheet for Full Load Amps and Wire Sizing Amps.**
2. **Field-supplied room unit main disconnect switch in accordance with local codes ordered as optional equipment and factory-installed in Liebert room unit.**
3. **For remote unit shutdown, replace jumper between 37 & 38 at terminal strip with Normally Closed switch having a minimum 75VA rating.**
4. **Special alarm connection made by adding Normally Open contacts between Terminals 24 & 50, 24 & 51, 24 & 55 and 24 & 56. Only one alarm (between 24 & 50) is available on standard microprocessor.**
5. **Heat rejection interlock is not supplied on chilled water models.**
6. **Field-supplied disconnect switch mounted within sight of condenser/drycooler and in accordance with local codes or ordered as optional equipment and factory-installed in Liebert condenser/drycooler. CDF-065, CDF-083, CDF-086, CDF-097 and CDF-104L are single-phase fan speed condensers. All other condensers and all drycooler and pump packages require a 3-phase line voltage supply.**
7. **Glycol pump package supplied with drycoolers only. Pump 2 is supplied only when dual pump package is ordered.**
8. **Lee-Temp tanks and assembly supplied on air-cooled condensers with Lee-Temp control systems only.**

Remote Heat Rejection Connections

Interconnected

2-wire connection plus ground for Lee-Temp heater pads (Note 8)

3- or single-phase line voltage supply to optional main disconnect switch (Note 6)

Earth Ground

2-wire connection for heat rejection interlock

3-wire line voltage connection plus ground for glycol pump. An additional 3-wire line voltage needed for dual pump packages (Note 7).

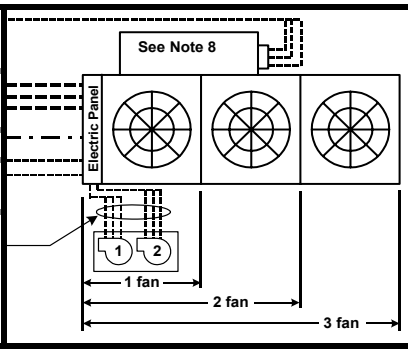
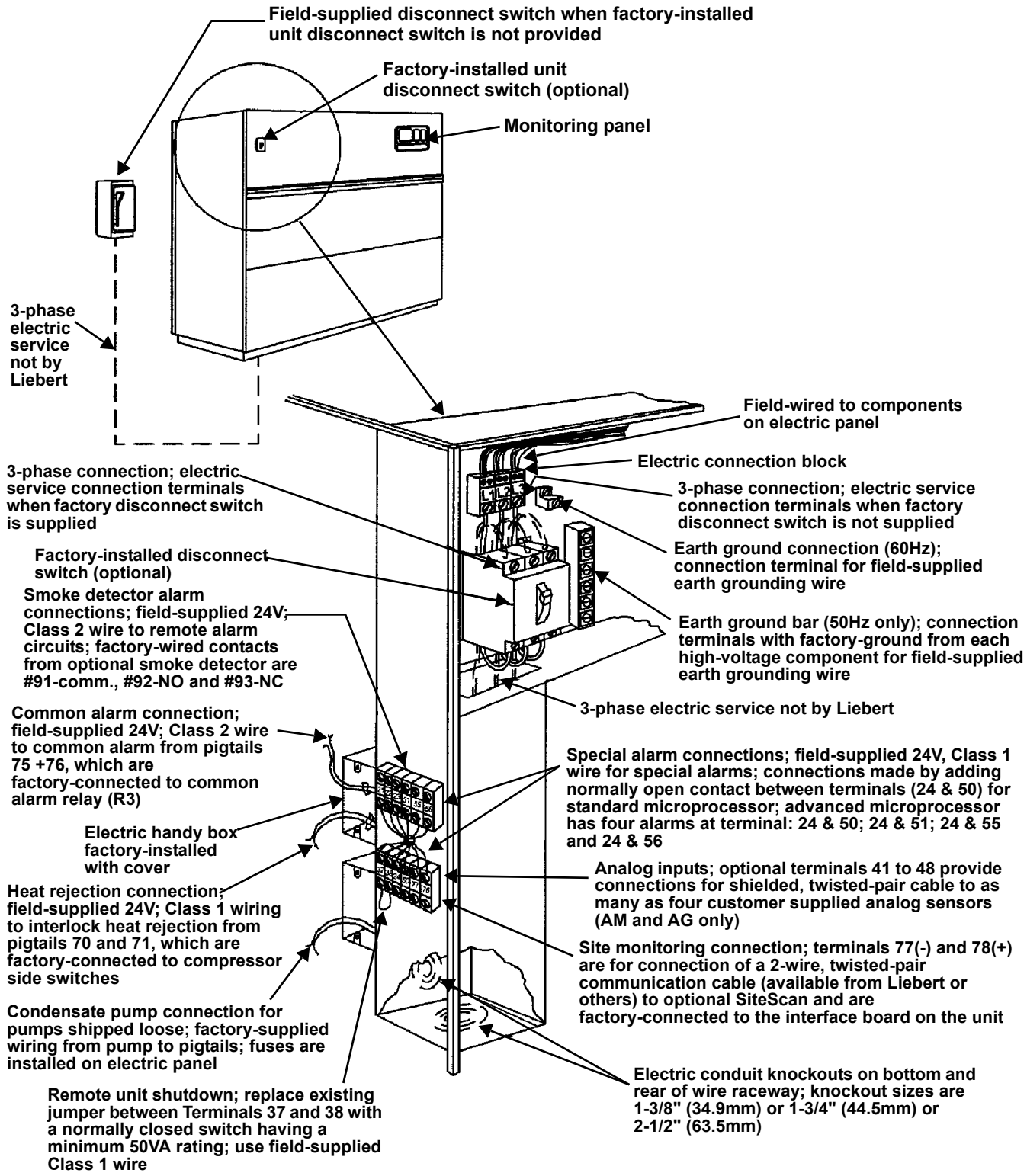


Diagram is for direct drive air-cooled condensers (for air-cooled units) and direct drive drycoolers (for glycol/GLYCOOL units).

Wire Legend

- **Factory-supplied line voltage wiring**
- **Field-supplied line voltage wiring**
- **Factory-supplied 24V, NEC Class 2 wiring**
- **Field-supplied 24V NEC Class 2 wiring**
- **Field-supplied earth grounding wire**

Figure 9 Electrical field connections


Field-supplied disconnect switch when factory-installed unit disconnect switch is not provided
Factory-installed unit disconnect switch (optional)
Monitoring panel
3-phase electric service not by Liebert
Field-wired to components on electric panel
Electric connection block
3-phase connection; electric service connection terminals when factory disconnect switch is not supplied
3-phase connection; electric service connection terminals when factory disconnect switch is supplied
Earth ground connection (60Hz); connection terminal for field-supplied earth grounding wire
Factory-installed disconnect switch (optional)
Smoke detector alarm connections; field-supplied 24V; Class 2 wire to remote alarm circuits; factory-wired contacts from optional smoke detector are #91-comm., #92-NO and #93-NC
Earth ground bar (50Hz only); connection terminals with factory-ground from each high-voltage component for field-supplied earth grounding wire
3-phase electric service not by Liebert
Common alarm connection; field-supplied 24V; Class 2 wire to common alarm from pigtails 75 +76, which are factory-connected to common alarm relay (R3)
Special alarm connections; field-supplied 24V, Class 1 wire for special alarms; connections made by adding normally open contact between terminals (24 & 50) for standard microprocessor; advanced microprocessor has four alarms at terminal: 24 & 50; 24 & 51; 24 & 55 and 24 & 56
Electric handy box factory-installed with cover
Analog inputs; optional terminals 41 to 48 provide connections for shielded, twisted-pair cable to as many as four customer supplied analog sensors (AM and AG only)
Heat rejection connection; field-supplied 24V; Class 1 wiring to interlock heat rejection from pigtails 70 and 71, which are factory-connected to compressor side switches
Site monitoring connection; terminals 77(-) and 78(+) are for connection of a 2-wire, twisted-pair communication cable (available from Liebert or others) to optional SiteScan and are factory-connected to the interface board on the unit
Condensate pump connection for pumps shipped loose; factory-supplied wiring from pump to pigtails; fuses are installed on electric panel
Electric conduit knockouts on bottom and rear of wire raceway; knockout sizes are 1-3/8" (34.9mm) or 1-3/4" (44.5mm) or 2-1/2" (63.5mm)
Remote unit shutdown; replace existing jumper between Terminals 37 and 38 with a normally closed switch having a minimum 50VA rating; use field-supplied Class 1 wire
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NOTE

Refer to specification sheet for full load amp and wire size amp ratings.

2.6 Air Distribution Considerations

2.6.1 Raised-Floor Air Flow Distribution Considerations

To ensure proper air distribution, any unusual restrictions within the air circuit must be avoided. For under-floor air distribution, observe the following guidelines:

Select the air supply grilles and perforated panels for the raised floor to ensure minimum loss of pressure in the circuit. Air volume dampers on grilles, which extend several inches below the surface of the raised floor, are usually detrimental to airflow. Consideration of the height of the damper on the grille in conjunction with the floor height will determine whether this type of grille may be used.

The grilles used in raised floors vary in size, the largest being approximately 18" x 6" (457 x 152 mm). A larger grille size would be detrimental to the structural capacity of the raised floor panel. An 18" x 6" (457 x 152mm) heavy-duty pencil-proof type grille typically has 56 square inches (0.036m^2) of free area. Perforated panels are available from various manufacturers of raised floors. These panels are usually 2' x 2' (610 x 610mm) square and have a nominal free area of approximately 108 to 144 square inches (0.07 to 0.09 m^2). Use caution in selecting perforated panels as some manufacturers have only 36 to 40 square inches (0.023 to 0.026 m^2) of free area, requiring four times as many panels.

Avoid floor elevations below 7-1/2" (190.5mm), loosely installed flooring systems, and below-floor obstructions such as: electrical wiring chases, unusually long computer system cables, or piping clusters.

All piping below the elevated floor must be located so that it offers the least resistance to air flow. Careful planning of the piping layout under the raised floor is required to prevent the air flow from being blocked. When installing piping on the subfloor, it is recommended that the pipes be mounted in a horizontal plane rather than stacked one above the other. Whenever possible, the pipes should be run parallel to the air flow.

Always check specifications of the floor supplier before specifying the total number of perforated panels and grilles required to handle the air flow. The proper specifications for grilles and perforated panels should indicate the total free area required for air delivery rather than the number of panels and grilles. (See **Table 5** below for recommended free area required for each model.) This table indicates the recommended free area based on having the supply air grilles and perforated panels sized to handle approximately 75% of the total cubic feet per minute (CFM) of the units at a velocity of 550 to 600 ft./min. (2.8 - 3.1 m/s). The remaining 25 percent of the air flow in the raised floor passes through cable cutouts, cracks between the panels and other leakage areas.

Table 5 Recommended free area ft^2 (m^2 for grilles or perforated panels at output velocities of 550 and 600 fpm (2.8 and 3.1 m/s)

	Model DH/DE or FH 60 (50) Hz			550 fpm (2.8 m/s)	600 fpm (3.1 m/s)
Direct Expansion Units	75A	86W	72G	4.6 (0.41)	4.2 (0.38)
	114A (115A)	122W (128W)	110G (111G)	6.3 (0.57)	5.8 (0.52)
	125A (130A)	138W (143W)	116G (121G)	7.7 (0.69)	7.1 (0.64)
	199A	219W	192G	11.5 (1.04)	10.5 (0.95)
	245A	267W	240G	13.9 (1.25)	12.8 (1.15)
	290A	315W	265G	16.4 (1.48)	15.0 (1.35)
	380A	412W	363G	20.4 (1.84)	18.8 (1.70)

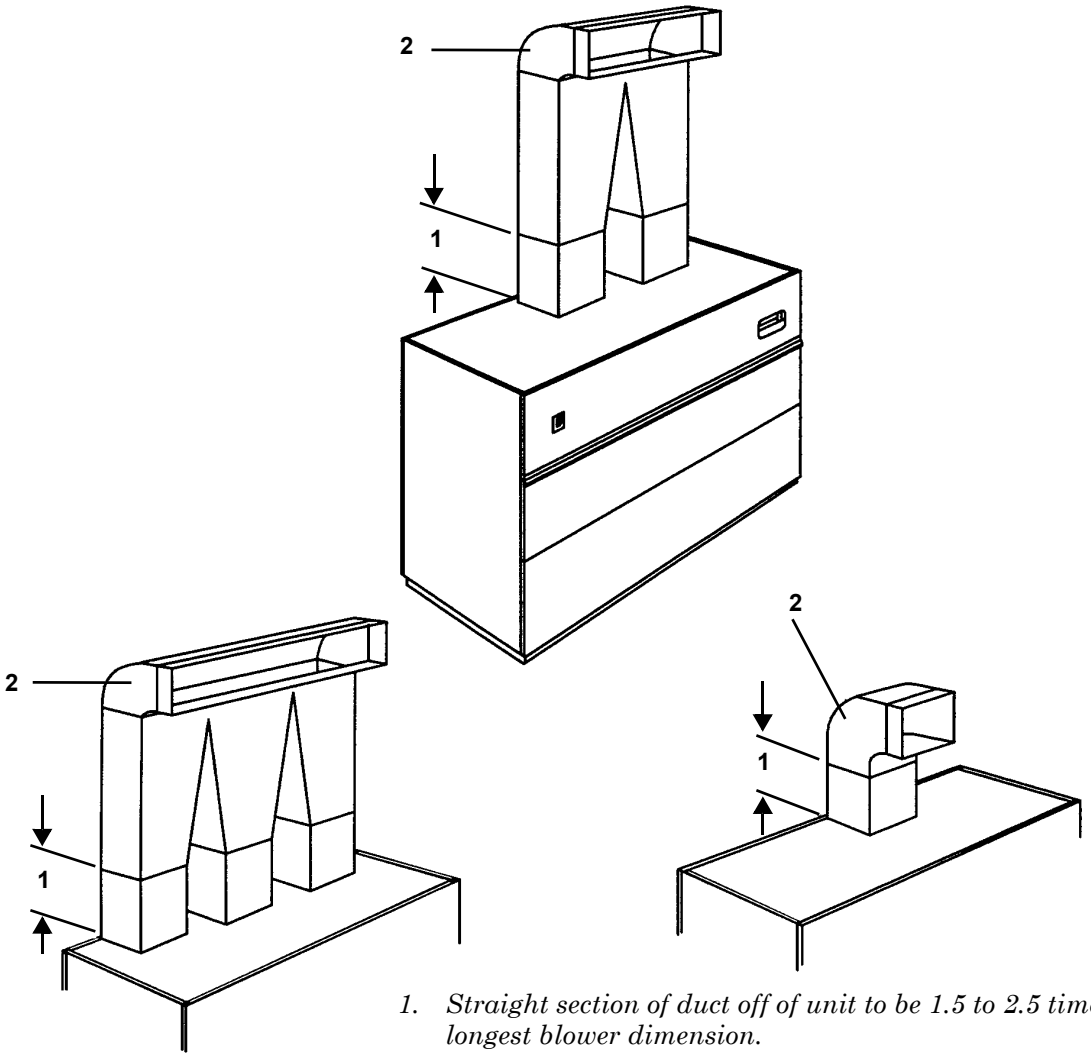
2.6.2 Upflow Systems Additional Installation Considerations

Upflow models can be configured in several different ways with front return, rear return, or bottom return and top front supply or top rear supply (on DX models). For in-room applications with no ductwork, and optional plenum with grill, proper clearance must be maintained on the return air side of the unit. For a front return, this means several feet in front of the unit. For a bottom return, at least 6-8 inches of unrestricted under-floor height is needed.

2.6.3 Ducted Application Installation

Duct flanges are supplied on the blower outlets. Follow the SWACNA-Duct Construction Standard for single-, dual-, or triple-blower systems. Do not run ductwork off the perimeter flange on the top of the unit. This flange is for positioning and attaching the optional air discharge plenum with grill. Attaching a duct to this flange may reduce airflow to inadequate levels.

Figure 10 Ducting configurations



1. *Straight section of duct off of unit to be 1.5 to 2.5 times the longest blower dimension.*
2. *Typical ducting shown; may run to either side.*

*** Follow standard practices on all duct work.**

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2.6.4 Plenum Installation

When installing the plenum to the top of system, secure the plenum to the unit flange using sheet metal screws.

2.6.5 Filter Box Installation

When installing the filter box to the back of the unit, secure the box to the unit using self tapping sheet metal screws. Seal around all edges with a silicone sealant to prevent air leakage.

Figure 11 Plenum dimensional data for 6 - 22 ton models

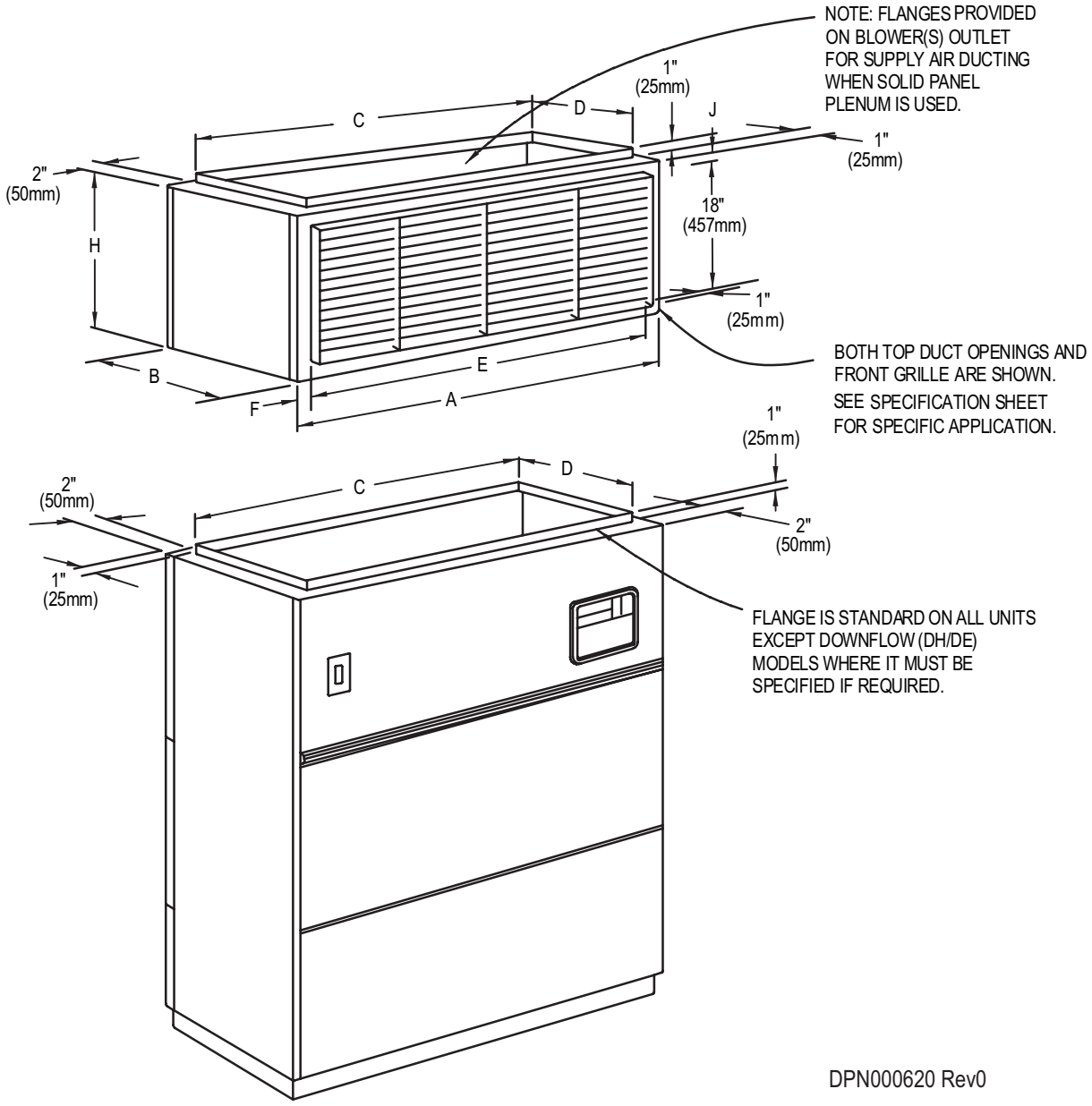


Table 6 Plenum dimensional data for 6 - 22 ton models, in. (mm)

Model	A	B	C	D	E	F	Grille Free Area Sq Ft (sq m)
DH/DE/VH/VE-75A, 86W, 72G DH/DE/VH/VE-115A, 128W, 111G DH/DE/VH/VE-114A, 127W, 110G DH/DE/VH/VE-130A, 143W, 121G DH/DE/VH/VE-125A, 138W, 116G	74 (1880)	34 (864)	70 (1778)	32 (813)	60 (1524)	7 (178)	5.85 (.54)
DH/DE/VH/VE-199A, 219W, 192G DH/DE/VH/VE-245A, 267W, 240G DH/VH/-290A, 315W, 265G	99 (2515)	34 (864)	95 (2413)	32 (813)	70 (1778)	14-1/2 (368)	6.83 (.63)

Plenum Height In. (mm)	
H	J
20 (508)	1 (25)
22-3/4 (578)	2-3/8 (60)
34-3/4 (883)	2-3/8 (60)

Figure 12 Plenum dimensional data for 30 ton models

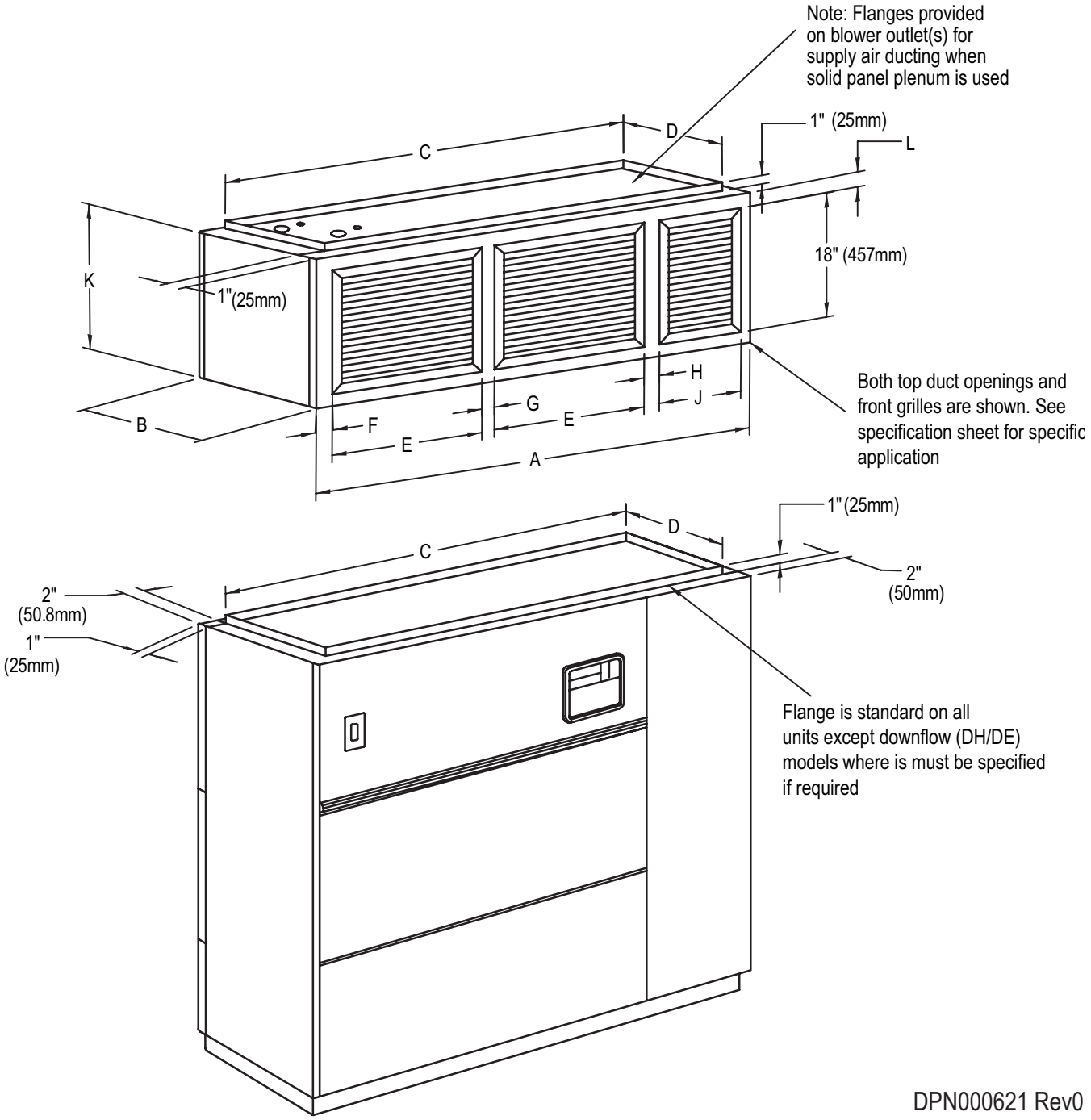


Table 7 Plenum dimensional data for 30 ton models in. (mm)

Model	A	B	C	D	E	F	G	H	J	K	L	Grille Free Area Sq Ft (sq m)
DH/DE/VH/VE-380A, 412W, 363G	122 (3099)	34 (864)	118 (2997)	32 (813)	44 (1118)	3-1/2 (89)	4 (102)	7 (178)	16 (406)	20 508)	1 (25)	10.14 (.94)

3.0 AIR COOLED MODELS

3.1 Condenser Location

3.1.1 Outdoor Prop Fan Models

The air cooled condenser should be located for maximum security and maintenance accessibility. Avoid ground level sites with public access or areas that contribute to heavy snow or ice accumulations. Utilize centrifugal condensers whenever interior building locations must be used. To assure adequate air supply, Liebert recommends that condensers be located in a clean air area, away from loose dirt and foreign matter that may clog the coil. Condensers should not be located in the vicinity of steam, hot air or fume exhausts. Also, condensers should be located no closer than 3 feet (1 meter) from a wall, obstruction or adjacent unit.

Install condensers in a level position to assure proper refrigerant flow and oil return. For roof installation, mount condensers on steel supports in accordance with local codes. To minimize sound and vibration transmission, mount steel supports across load bearing walls.

For ground installation, a concrete pad will provide adequate support. Condenser legs have mounting holes for securing the condenser to steel supports or concrete pad.

3.1.2 Indoor Piggyback Models

The piggyback condenser can be located directly behind the Deluxe unit or in a separate remote indoor location. It may be placed directly against an outside wall, with the proper openings cut in the wall for entering and leaving air. If it cannot be located near a wall, the unit may be ducted to the outside. Proper grilles/screens are required on the outside wall.

3.2 Electrical Connections

3.2.1 High Voltage

High voltage electrical service is required for all air cooled condensers at the location of the condenser. This power supply does not have to be the same voltage as the indoor unit. This separate power source may be 208/230, 460 or 575V, 60Hz; or 200/230 or 380/415V, 50Hz. The disconnect switch may be factory supplied and mounted in the electrical panel or field supplied and mounted per local and national codes.

3.2.2 Low Voltage

A control interlock between the condenser and the indoor unit is required and is connected between 70 and 71 on the wire raceway in the compressor compartment of the indoor unit and the electric panel of the air cooled condenser.

3.2.3 Lee-Temp/Flood Back Head Pressure Control Condensers (Standard on Piggyback Models)

Lee-Temp condensers require a separate power supply for the heated receivers. This power supply is connected to the electrical connection box on the end of the receiver.

3.3 Refrigerant Piping

All refrigeration piping should be installed with high temperature brazed joints. Prevailing good refrigeration practices should be employed for piping supports, leak testing, dehydration and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building by the use of vibration isolating supports. **Piping, including inverted trap(s), must be routed to allow unobstructed access to the panel per the NEC.**

Traps should be installed in the hot gas lines on vertical risers every 25 feet (7.6 meters) in elevation. These traps will collect condensed refrigerant and refrigerant oil during the off cycle of the unit and ensure flow of refrigerant oil during operation. Hot gas vertical risers may require downsizing of the line to provide for adequate refrigerant velocities to move oil up the riser. This is especially true on systems with unloaders.

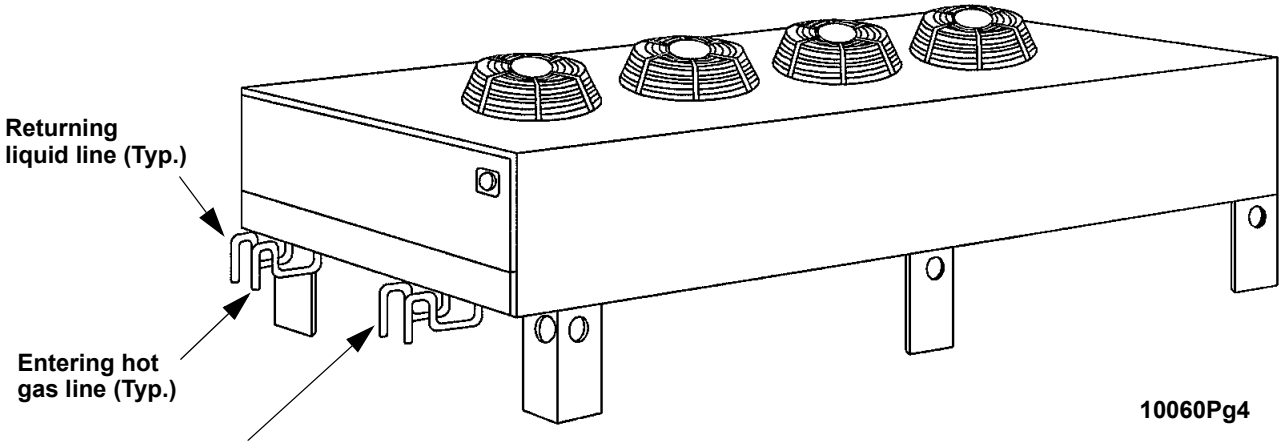
Contact your local Liebert representative for factory approval whenever a refrigerant piping run exceeds 200 feet (60 meters) equivalent length or when condensers must be located below the level of the cooling coil.

Table 8 Recommended line sizes – O.D. copper

	75A		114A (115A)		125A (130A)		199A		245A		290A		380A	
	Hot Gas Line	Liq. Line	Hot Gas Line	Liq. Line	Hot Gas Line	Liq. Line	Hot Gas Line	Liq. Line	Hot Gas Line	Liq. Line	Hot Gas Line	Liq. Line	Hot Gas Line	Liq. Line
50 ft (15m)	5/8	1/2	7/8*	1/2	7/8*	1/2	7/8	5/8	1-1/8*	7/8	1-1/8	7/8	1-3/8	7/8
100 ft. (30m)	7/8	1/2	7/8*	5/8	7/8	5/8	1-1/8*	7/8	1-1/8	7/8	1-1/8	7/8	1-3/8	7/8
150 ft. (45m)	7/8	5/8	7/8	5/8	7/8	5/8	1-1/8	7/8	1-1/8	7/8	1-1/8	7/8	1-3/8	1-1/8

*With 4-Step Models, use one (1) trade size smaller (7/8 = 3/4, 1-1/8 = 7/8).

Figure 13 Piping: Fan speed control condensers



Inverted traps are to be field-supplied and installed (Typ.). When installing traps, clearance must be provided for swing of end access door. Traps are to extend above base of coil by a minimum of 7-1/2" (190mm).

Table 9 Fan speed control condenser piping connection sizes - Cu OD

Condenser Model Number	Entering Hot Gas Line In. (mm)	Returning Liquid Line In. (mm)
CDF-065	1/2 (12.7)	1/2 (12.7)
CDF-083L	1/2 (12.7)	1/2 (12.7)
CDF-086	7/8 (22.2)	1/2 (12.7)
CDF-097/107C	7/8 (22.2)	1/2 (12.7)
CDF-104L	7/8 (22.2)	1/2 (12.7)
CDF-130	7/8 (22.2)	5/8 (15.9)
CDF-165L	7/8 (22.2)	5/8 (15.9)
CDF-175	7/8 (22.2)	5/8 (15.9)
CDF-205L	1-1/8 (28.6)	7/8 (22.2)
CDF-217C/216C	1-1/8 (28.6)	7/8 (22.2)
CDF-251L	1-1/8 (28.6)	7/8 (22.2)
CDF-258	1-1/8 (28.6)	7/8 (22.2)
CDF-291	1-1/8 (28.6)	1-1/8 (28.6)
CDF-308L	1-3/8 (34.9)	1-1/8 (28.6)
CDF-330L	1-3/8 (34.9)	1-1/8 (28.6)
CDF-360/349C	1-3/8 (34.9)	1-1/8 (28.6)
CDF-415L	1-3/8 (34.9)	1-1/8 (28.6)
CDF-480C	1-5/8 (41.3)	1-1/8 (28.6)
CDF-510C	1-5/8 (41.3)	1-1/8 (28.6)

For runs longer than 150 feet (45.7m) equivalent length, consult factory for proper line sizing.

Figure 14 Piping: Lee-Temp control condensers

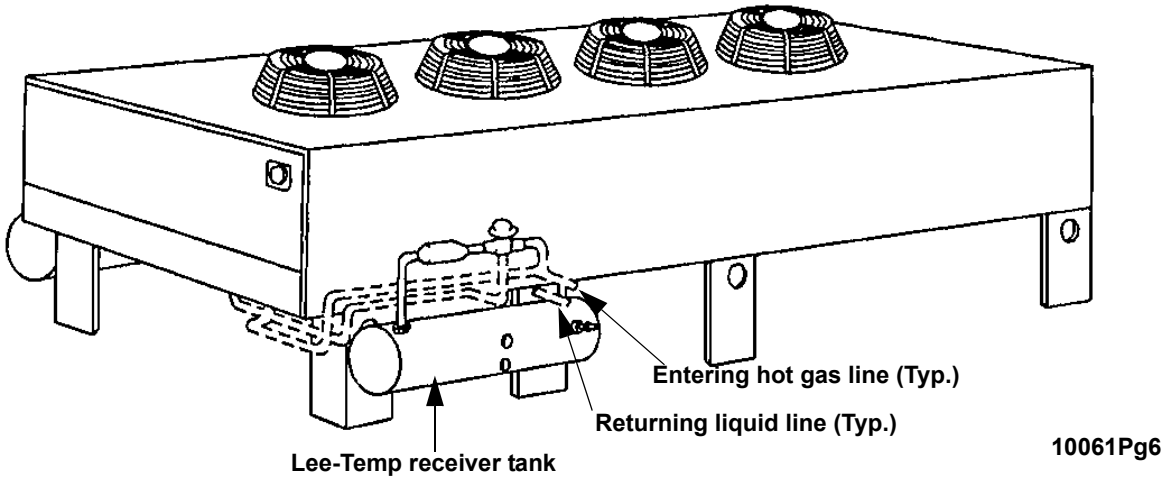


Table 10 Lee-Temp control condenser piping connection sizes

Condenser Connections-ODS inches (mm)				Lee-Temp Connections-ODS inches (mm)		
Model #	Hot Gas A	Liquid B	Lee-Temp Size	Hot Gas Tee F	Liq. to L-T Valve C	Receiver Out D
CDL-065	1/2 (12.7)	1/2 (12.7)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-083L	1/2 (12.7)	1/2 (12.7)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-086	7/8 (22.2)	1/2 (12.7)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-097	7/8 (22.2)	1/2 (12.7)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-104L	7/8 (22.2)	1/2 (12.7)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-130	7/8 (22.2)	5/8 (15.9)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-165	7/8 (22.2)	5/8 (15.9)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-175	7/8 (22.2)	5/8 (15.9)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-205L	1-1/8 (28.6)	7/8 (22.2)	(2) W-4	1-1/8 (28.6)	7/8 (22.2)	5/8 (15.9)
CDL-217C	1-1/8 (28.6)	7/8 (22.2)	(2) W-5	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-251L	1-1/8 (28.6)	7/8 (22.2)	(2) W-4	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-258	1-1/8 (28.6)	7/8 (22.2)	(2) W-5	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-291	1-1/8 (28.6)	5/8 (15.9)	(2) W-5	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-308L	1-3/8 (34.9)	1-1/8 (28.6)	(2) W-5	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-330L	1-3/8 (34.9)	1-1/8 (28.6)	(2) W-5	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-360	1-3/8 (34.9)	1-1/8 (28.6)	(2) W-5	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-415L	1-3/8 (34.9)	1-1/8 (28.6)	(2) W-5	1-3/8 (34.9)	7/8 (22.2)	7/8 (22.2)
CDL-480C	1-5/8 (41.3)	1-1/8 (28.6)	(2) W-6	1-3/8 (34.9)	1-1/8 (28.6)	7/8 (22.2)
CDL-510C	1-5/8 (41.3)	1-1/8 (28.6)	(2) W-41	1-3/8 (34.9)	1-1/8 (28.6)	7/8 (22.2)

For runs longer than 150 feet (45.7m) equivalent length, consult factory for proper line sizing.

Figure 15 Downflow air cooled (DH) piping connections

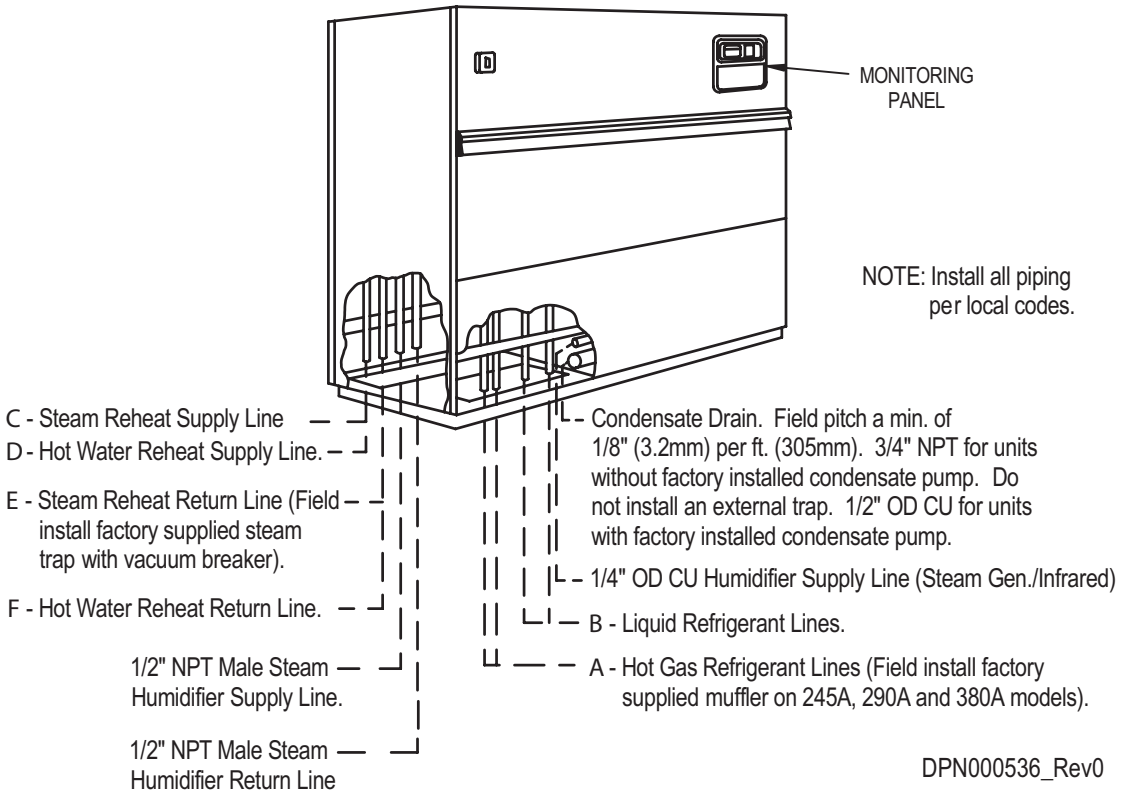

MONITORING PANEL
NOTE: Install all piping per local codes.
C - Steam Reheat Supply Line
D - Hot Water Reheat Supply Line.
E - Steam Reheat Return Line (Field install factory supplied steam trap with vacuum breaker).
F - Hot Water Reheat Return Line.
1/2" NPT Male Steam Humidifier Supply Line.
1/2" NPT Male Steam Humidifier Return Line
Condensate Drain. Field pitch a min. of 1/8" (3.2mm) per ft. (305mm). 3/4" NPT for units without factory installed condensate pump. Do not install an external trap. 1/2" OD CU for units with factory installed condensate pump.
1/4" OD CU Humidifier Supply Line (Steam Gen./Infrared)
B - Liquid Refrigerant Lines.
A - Hot Gas Refrigerant Lines (Field install factory supplied muffler on 245A, 290A and 380A models).
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Table 11 Downflow air cooled (DH) piping connection sizes, inches

Air Cooled Models 60 Hz (50 Hz)	A (AO Cu)	B (OD Cu)	C (NPT Male)	D (OD Cu)	E (NPT Male)	F (OD Cu)
DH075A (DH075A)	5/8	1/2	1/2	5/8	1/2	5/8
DH114A (DH115A)	5/8	1/2	1/2	5/8	1/2	5/8
DH125A (DH130A)	5/8	1/2	1/2	5/8	1/2	5/8
DH199A (DH199A)	7/8	1/2	3/4	7/8	3/4	7/8
DH245A (DH245A)	1-1/8	5/8	3/4	7/8	3/4	7/8
DH290A (DH290A)	1-1/8	5/8	NA	NA	NA	NA
DH380A (DH380A)	1-1/8	5/8	NA	NA	NA	NA

Figure 16 Upflow air cooled (VH) piping connections

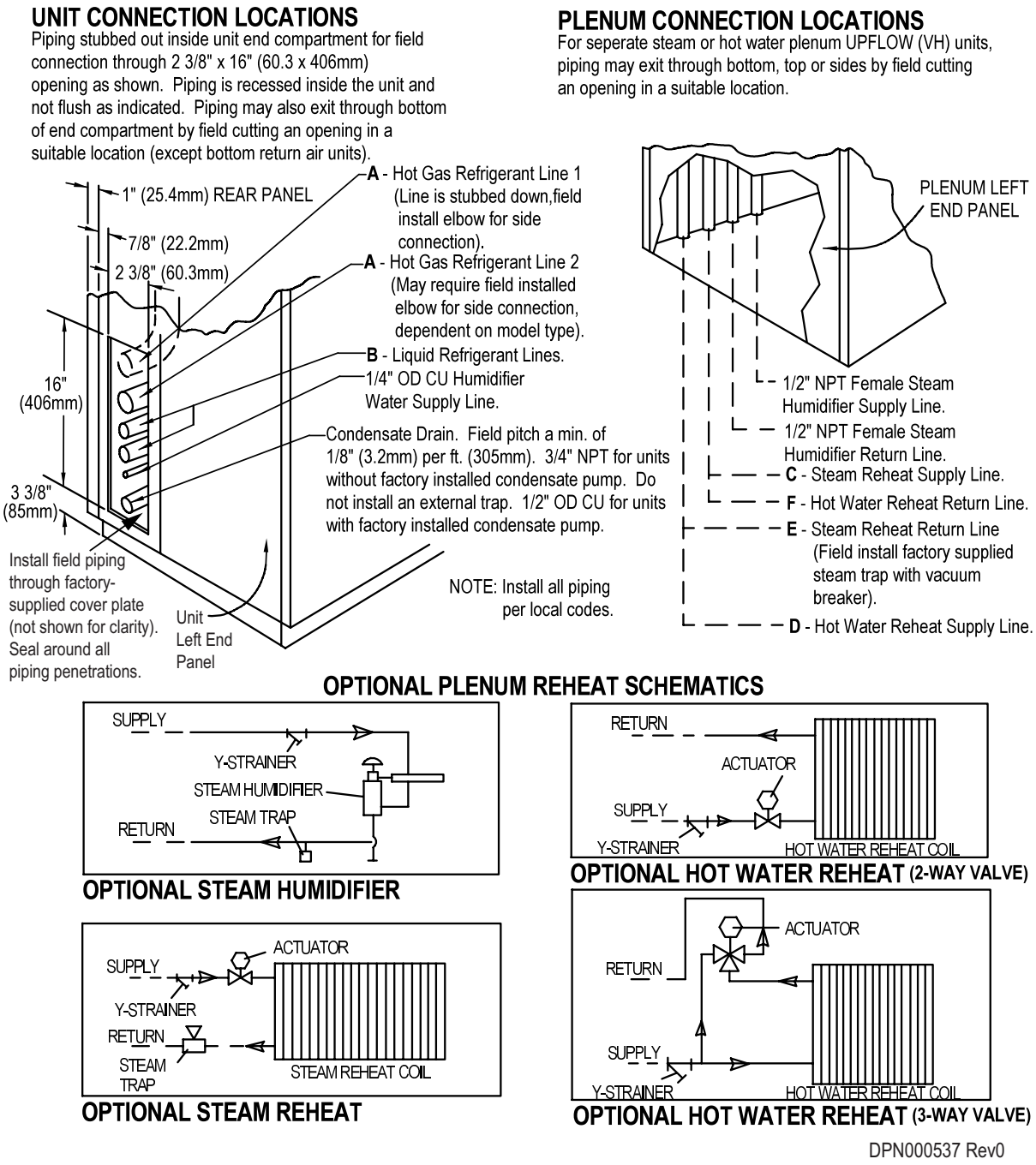
UNIT CONNECTION LOCATIONS
Piping stubbed out inside unit end compartment for field connection through 2 3/8" x 16" (60.3 x 406mm) opening as shown. Piping is recessed inside the unit and not flush as indicated. Piping may also exit through bottom of end compartment by field cutting an opening in a suitable location (except bottom return air units).
PLENUM CONNECTION LOCATIONS
For seperate steam or hot water plenum UPFLOW (VH) units, piping may exit through bottom, top or sides by field cutting an opening in a suitable location.
1" (25.4mm) REAR PANEL
7/8" (22.2mm)
2 3/8" (60.3mm)
16" (406mm)
3 3/8" (85mm)
A - Hot Gas Refrigerant Line 1 (Line is stubbed down,field install elbow for side connection).
A - Hot Gas Refrigerant Line 2 (May require field installed elbow for side connection, dependent on model type).
B - Liquid Refrigerant Lines.
1/4" OD CU Humidifier Water Supply Line.
Condensate Drain. Field pitch a min. of 1/8" (3.2mm) per ft. (305mm). 3/4" NPT for units without factory installed condensate pump. Do not install an external trap. 1/2" OD CU for units with factory installed condensate pump.
Install field piping through factory-supplied cover plate (not shown for clarity). Seal around all piping penetrations.
Unit Left End Panel
NOTE: Install all piping per local codes.
PLENUM LEFT END PANEL
1/2" NPT Female Steam Humidifier Supply Line.
1/2" NPT Female Steam Humidifier Return Line.
C - Steam Reheat Supply Line.
F - Hot Water Reheat Return Line.
E - Steam Reheat Return Line (Field install factory supplied steam trap with vacuum breaker).
D - Hot Water Reheat Supply Line.
OPTIONAL PLENUM REHEAT SCHEMATICS
SUPPLY
Y-STRAINER
STEAM HUMIDIFIER
STEAM TRAP
RETURN
OPTIONAL STEAM HUMIDIFIER
ACTUATOR
SUPPLY
Y-STRAINER
RETURN
STEAM TRAP
STEAM REHEAT COIL
OPTIONAL STEAM REHEAT
RETURN
ACTUATOR
SUPPLY
Y-STRAINER
HOT WATER REHEAT COIL
OPTIONAL HOT WATER REHEAT (2-WAY VALVE)
ACTUATOR
RETURN
SUPPLY
Y-STRAINER
HOT WATER REHEAT COIL
OPTIONAL HOT WATER REHEAT (3-WAY VALVE)

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Table 12 Factory provided piping connection sizes, inches, upflow air cooled (VH)

Air Cooled Models		A	B	C	D	E	F
50Hz	60Hz	OD Cu	OD Cu	NPT Female	OD Cu	NPT Female	OD Cu
VH-075A	VH-075A	5/8	1/2	1/2	5/8	1/2	5/8
VH-115A	VH-114A	5/8	1/2	1/2	5/8	1/2	5/8
VH-130A	VH-125A	5/8	1/2	1/2	5/8	1/2	5/8
VH-199A	VH-199A	7/8	1/2	3/4	7/8	3/4	7/8
VH-245A	VH-245A	11/8	5/8	3/4	7/8	3/4	7/8
VH-290A	VH-290A	1-1/8	5/8	NA	NA	NA	NA
VH-380A	VH-380A	1-1/8	5/8	NA	NA	NA	NA

Figure 17 Outdoor air cooled 1-4 fan condenser cabinet and anchor dimensional data

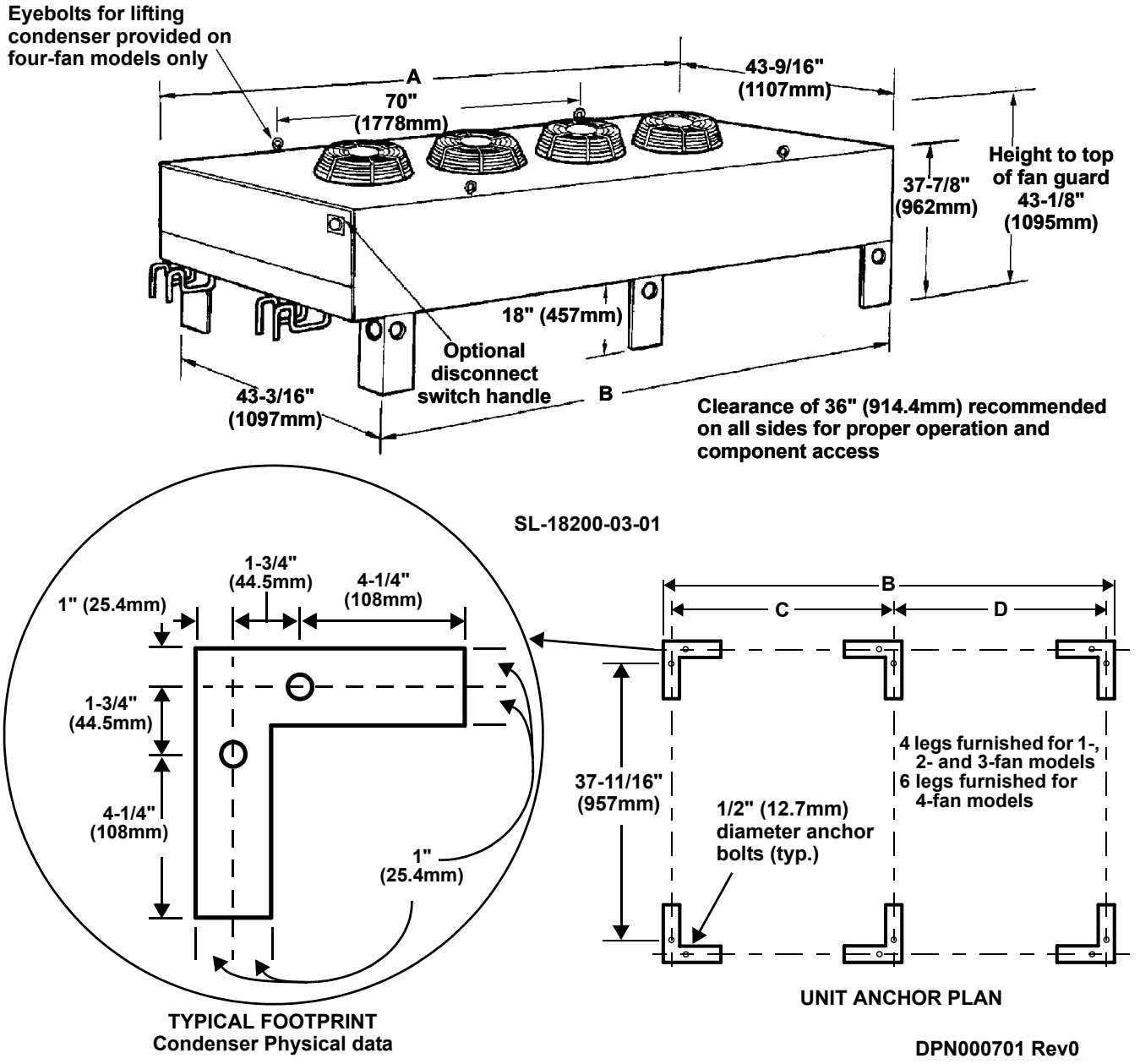

Table 13 Outdoor air cooled 1-4 fan condenser physical data

Model CSF/CDF[1]	# of Fans	A	B	C	D	Total Heat Rejection 60 Hz[3]		CFM (l/s) 60 Hz[2]	Total Heat Rejection 50 Hz[3]		CFM (l/s) 50 Hz[2]	Net Weight lb (kg)
		in. (mm)	in. (mm)	in. (mm)	in. (mm)	BTU/H/°F	kW/°C		BTU/H/°F	kW/°C		
-065	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	1464	.772	6866 (3240)	1349	.712	5722 (2700)	295 (134)
-083L	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	1655	.873	6000 (2831)	1526	.805	5000 (2359)	295 (134)
-086	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	1921	1.013	6633 (3130)	1751	.924	5527 (2608)	315 (413)
-097	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	2228	1.176	6322 (2983)	1995	1.053	5268 (2486)	335 (152)
-104L	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	1945	1.026	5400 (2548)	1733	.914	4500 (2123)	315 (143)
-107C	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	1938	1.022	6322 (2984)	1750	.923	5265 (2485)	420 (191)
-130	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	2928	1.545	13732 (6480)	2698	1.423	11443 (5400)	425 (193)
-165L	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	3310	1.746	12000 (5663)	3051	1.610	10000 (4719)	425 (193)
-175	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	3842	2.027	13266 (6260)	3502	1.847	11055 (5217)	495 (225)
-205L	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	3976	2.098	10443 (4928)	3509	1.851	8703 (4107)	495 (225)
-216C	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	4324	2.281	12176 (5747)	3836	2.023	10132 (4782)	655 (297)
-217C	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	4721	2.491	12644 (5967)	4204	2.218	10537 (4972)	515 (234)
-251L	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	4965	2.619	18000 (8494)	4577	2.415	15000 (7078)	500 (227)
-258	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	5763	3.040	19899 (9390)	5252	2.771	16582 (7825)	670 (305)
-291	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	6685	3.527	18966 (8950)	5986	3.158	15805 (7458)	741 (337)
-308L	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	5664	2.988	15665 (7392)	5264	2.777	13054 (6160)	670 (305)
-330L	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	6619	3.492	24000 (11326)	6103	3.220	20000 (9438)	780 (355)
-349C	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	6984	3.684	17397 (8211)	6174	3.256	14532 (6859)	916 (415)
-415L	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	7779	4.104	21600 (10193)	6932	3.657	18000 (8494)	815 (370)
-480C	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	8915	4.703	25288 (11933)	7981	4.211	21073 (9944)	1025 (466)
-510C	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	10086	5.321	21687 (10234)	8763	4.623	18072 (8528)	1188 (540)

1. CSF model prefix is for single refrigeration circuit. CDF model prefix is for dual refrigeration circuits.
2. All condenser fan motors are 3/4 HP.
3. Total Heat Rejection given above is per circuit for CDF models. For CSF models double the capacity shown. The Total Heat Rejection is for each degree differential between saturated condensing temperature and entering ambient air temperature. To calculate Total Heat Rejection per condenser, multiply table value by temperature differential.

Figure 18 Outdoor air cooled 6 and 8 fan condenser cabinet and anchor dimensional data

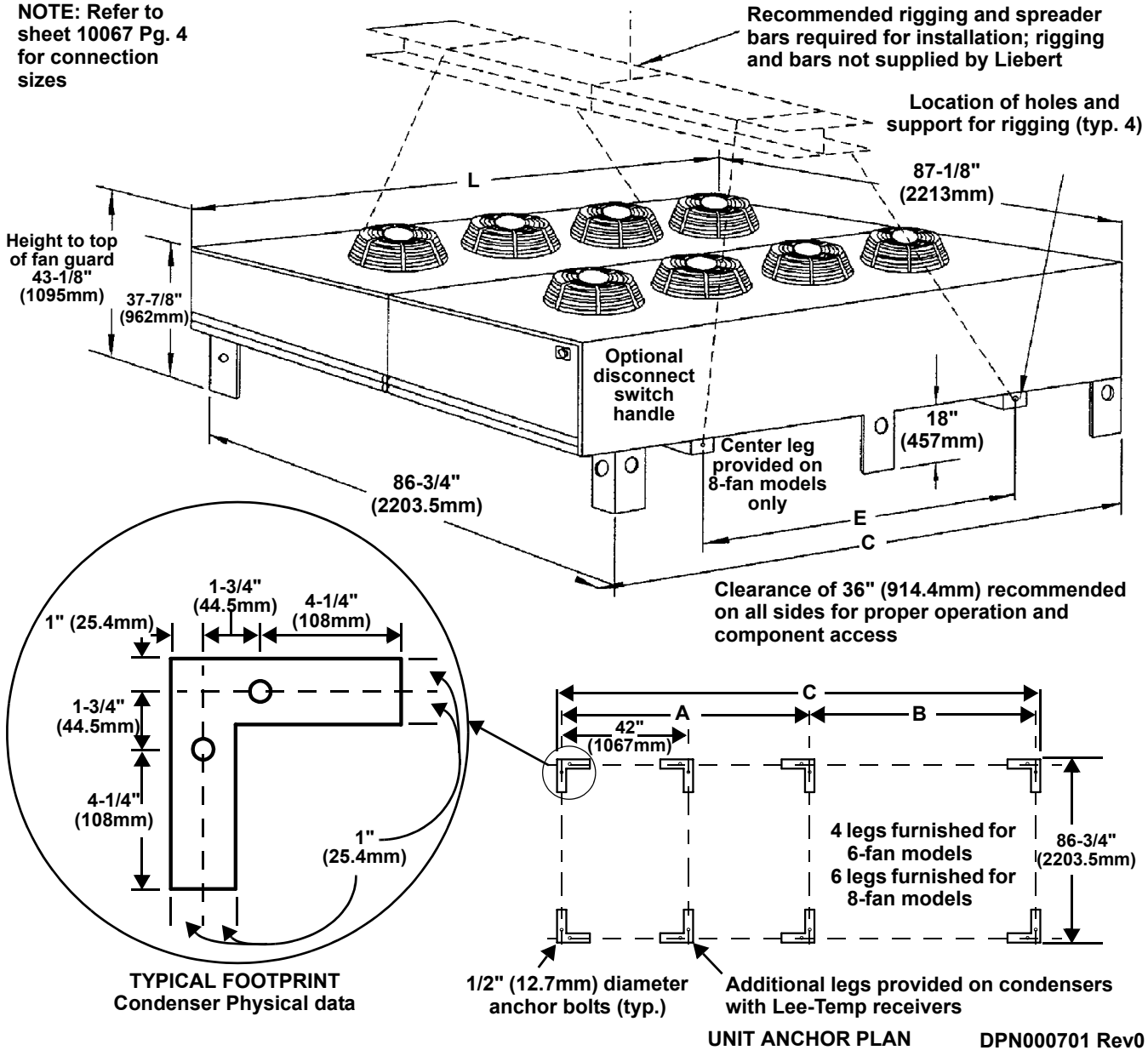
NOTE: Refer to sheet 10067 Pg. 4 for connection sizes
Recommended rigging and spreader bars required for installation; rigging and bars not supplied by Liebert
Location of holes and support for rigging (typ. 4)
L
87-1/8" (2213mm)
Height to top of fan guard 43-1/8" (1095mm)
37-7/8" (962mm)
Optional disconnect switch handle
18" (457mm)
Center leg provided on 8-fan models only
86-3/4" (2203.5mm)
E
C
Clearance of 36" (914.4mm) recommended on all sides for proper operation and component access
1-3/4" (44.5mm)
4-1/4" (108mm)
1" (25.4mm)
1-3/4" (44.5mm)
4-1/4" (108mm)
1" (25.4mm)
C
A
B
42" (1067mm)
4 legs furnished for 6-fan models
6 legs furnished for 8-fan models
86-3/4" (2203.5mm)
TYPICAL FOOTPRINT
Condenser Physical data
1/2" (12.7mm) diameter anchor bolts (typ.)
Additional legs provided on condensers with Lee-Temp receivers
UNIT ANCHOR PLAN
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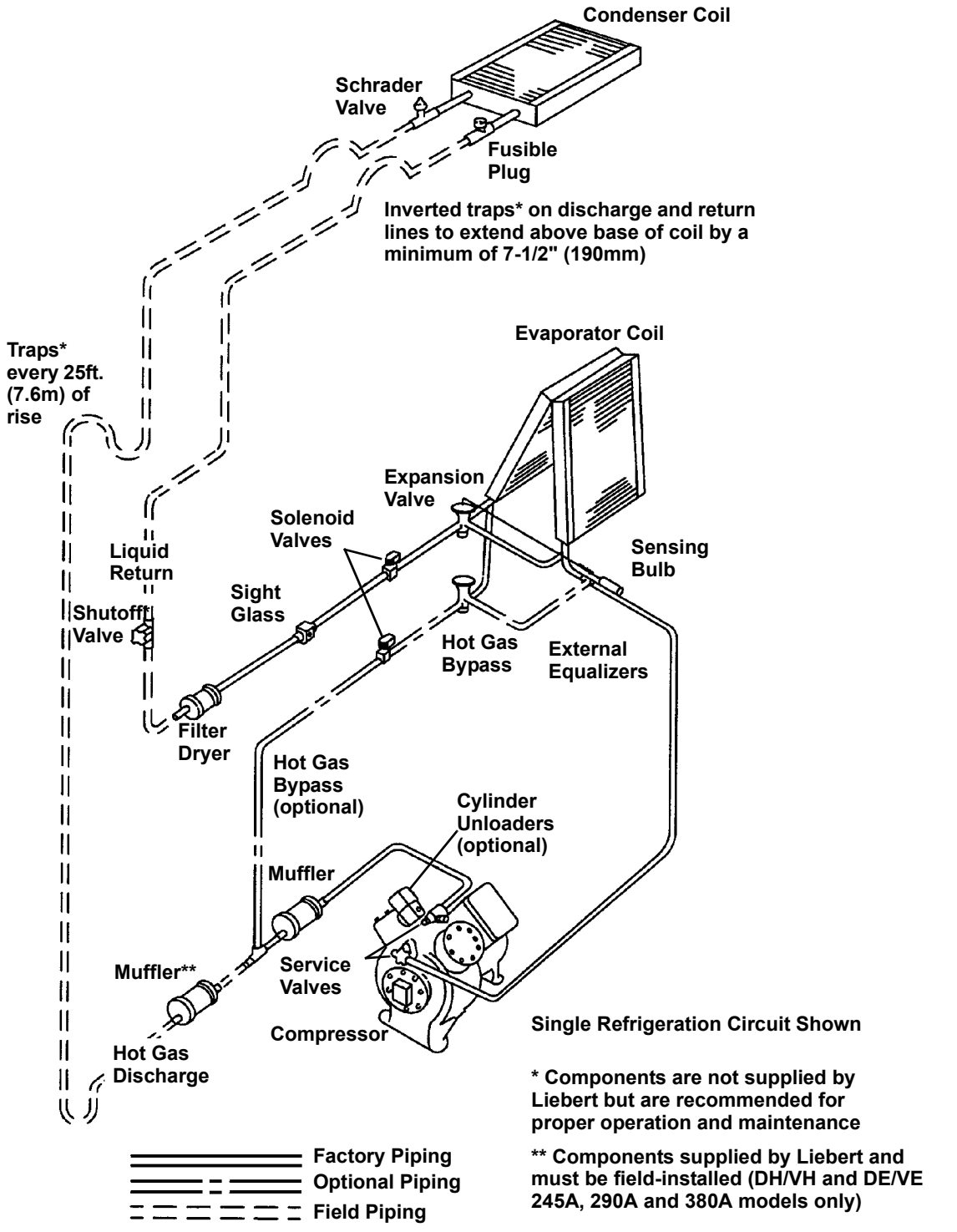
Table 14 Outdoor air cooled 6 and 8 fan condenser physical data

Model	# of Fans	A in (mm)	B in (mm)	C in (mm)	E in (mm)	L in (mm)	CFM (l/s) 60 Hz	THR 60 Hz. BTU/hr (kw)	CFM (l/s) 50 Hz	THR 50 Hz BTU/hr (kW)	Net Weight lb (kg)
-616L	6	122 (3099)	–	124 (3150)	59 (1499)	131-1/2 (3340)	31330 (14785)	23854 (12.6)	26108 (12320)	21056 (11.2)	1380 (627)
-660L	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	48000 (22651)	26478 (14.0)	40000 (18875)	24412 (12.8)	1600 (727)
-830L	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	43200 (20386)	31114 (16.4)	36000 (16988)	27366 (14.6)	1670 (759)
-960C	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	50576 (23876)	35660 (18.8)	42146 (19888)	31926 (16.8)	2090 (950)
-1010C	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	43400 (20485)	40344 (21.3)	36167 (17070)	35050 (18.5)	2640 (1198)

THR - Total Heat Rejection, 1°F TD, for Total Condenser
THR - Total Heat Rejection, 1°C TD, for Total Condenser (50 Hz)

Figure 19 Air cooled model general arrangement diagram



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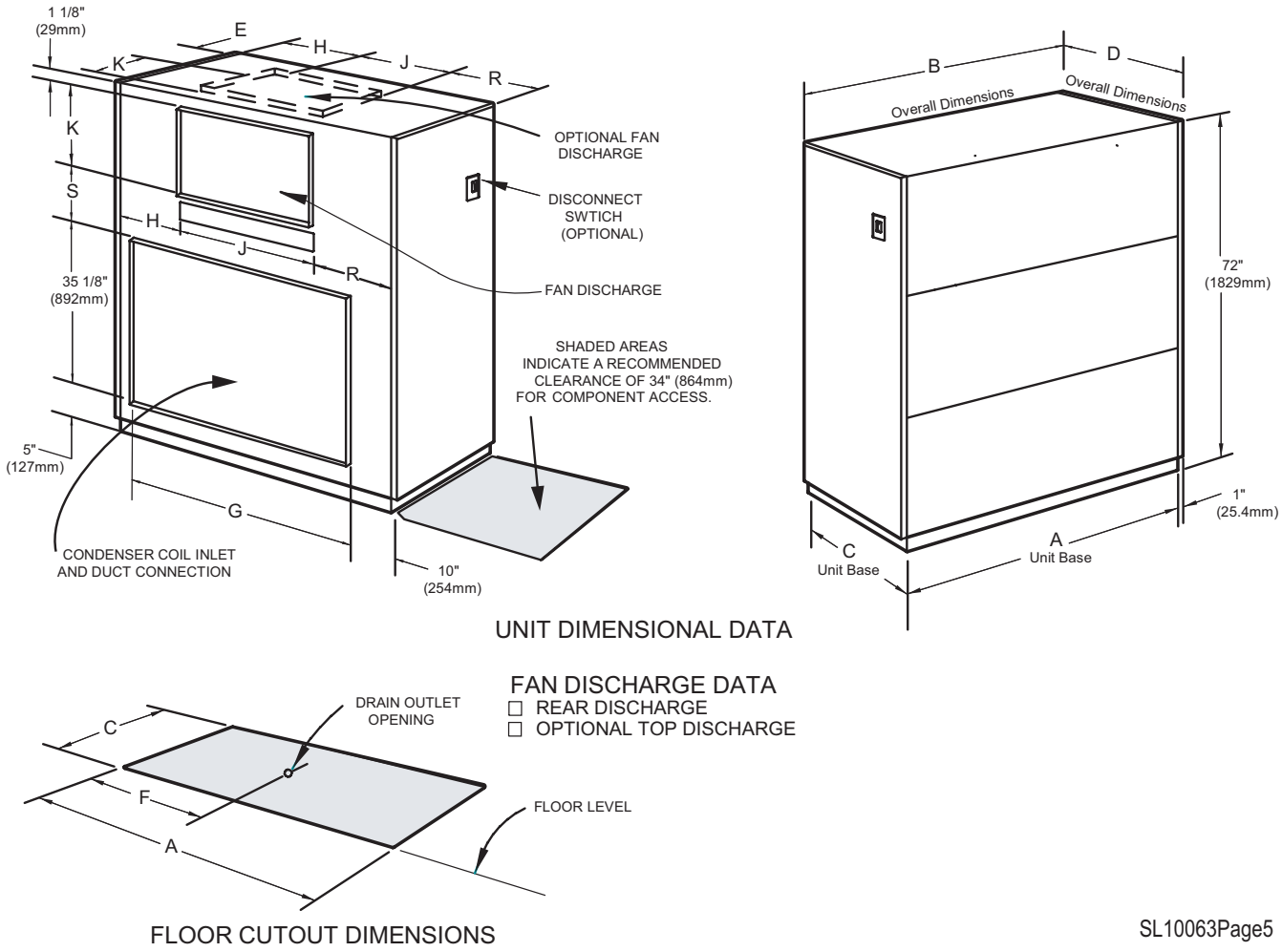
NOTE

Two refrigeration circuits required - Single circuit shown only for clarity

Table 15 Refrigerant control settings psi (kPa)

Model	Refrigerant Type	Low Pressure Cut Out	Low Pressure Cut In	High Pressure Cut Out
Fan Speed Control	R-22	15 (103.4)	35 (241.3)	360 (2482)
Lee-Temp	R-22	20 (137.9)	65 (448.2)	360 (2482)

Figure 20 Piggyback condenser cabinet and floor planning dimensional data



NOTE

A 1" (25.4mm) flange is provided on all units for duct connection to coil duct opening and fan air discharge opening.

Table 16 Piggyback condenser dimensional data

Model	Dimensional Data in. (mm)												Shipping Weight lb (kg)
	A	B	C	D	E	F	G	H	J	K	R	S	
PB350A	72 (1829)	74 (1880)	31 (787)	32 (813)	1-1/8 (29)	33 (838)	60 (1524)	8-5/8 (219)	50-3/16 (1275)	16-1/16 (408)	13-3/16 (335)	14-11/16 (373)	1180 (535)
PB550A	72 (1829)	74 (1880)	31 (787)	32 (813)	1-1/8 (29)	33 (838)	60 (1524)	8-5/8 (219)	50-3/16 (1275)	16-1/16 (408)	13-3/16 (335)	14-11/16 (373)	1180 (535)
PB675A	72 (1829)	74 (1880)	31 (787)	32 (813)	1-1/8 (29)	33 (838)	60 (1524)	8-5/8 (219)	50-3/16 (1275)	16-1/16 (408)	13-3/16 (335)	14-11/16 (373)	1180 (535)
PB925A	97 (2464)	99 (2515)	33 (838)	34 (864)	3-1/8 (79)	45-1/2 (1156)	85 (2159)	23-5/16 (592)	50-3/16 (1275)	16-1/16 (408)	23-1/2 (597)	14-11/16 (373)	1630 (739)
PB1100A	97 (2464)	99 (2515)	33 (838)	34 (864)	3-1/8 (79)	45-1/2 (1156)	85 (2159)	23-5/16 (592)	50-3/16 (1275)	16-1/16 (408)	23-1/2 (597)	14-11/16 (373)	1630 (739)
PB1350A	97 (2464)	99 (2515)	33 (838)	34 (864)	3-1/8 (79)	45-1/2 (1156)	85 (2159)	16-5/16 (421)	63-7/8 (1622)	19-1/8 (486)	16-13/16 (427)	11-5/8 (295)	1630 (739)

Figure 21 Piggyback condenser piping connections

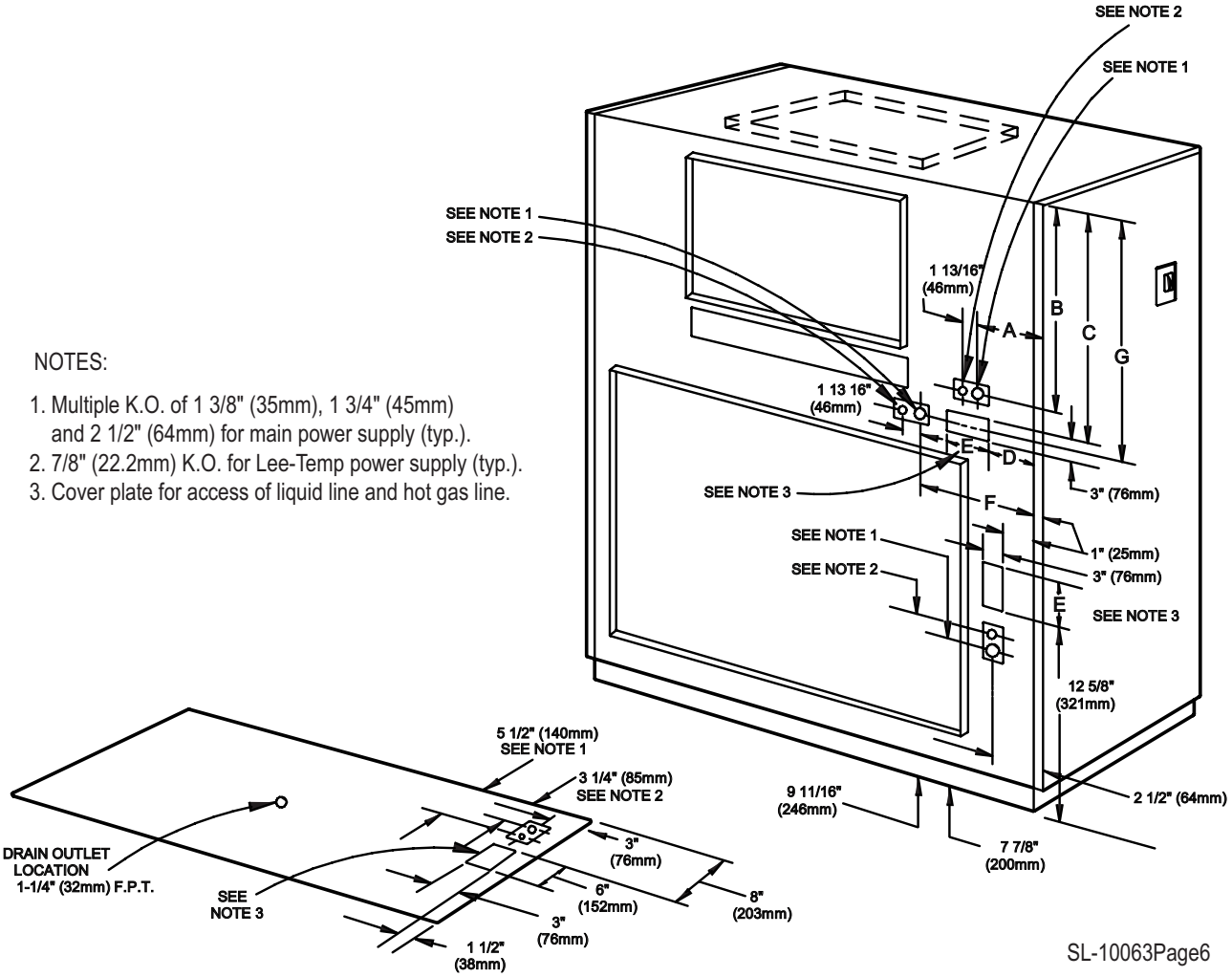


Table 17 Piggyback condenser piping connection dimensional data

Model	Dimensional Data							Connection Sizes O.D.S., inches (mm)		
	A	B	C	D	E	F	G	Liquid Line	Hot Gas Line	Drain
PB350A	–	–	27-1/4 (692)	1-1/2 (38)	6 (152)	9-1/8 (232)	28-3/4 (730)	2 @ 1/2 (13)	2 @ 5/8 (16)	1-1/4 (32)
PB550A	–	–	27-1/4 (692)	1-1/2 (38)	6 (152)	9-1/8 (232)	28-3/4 (730)	2 @ 1/2 (13)	2 @ 5/8 (16)	1-1/4 (32)
PB675A	–	–	27-1/4 (692)	1-1/2 (38)	6 (152)	9-1/8 (232)	28-3/4 (730)	2 @ 1/2 (13)	2 @ 7/8 (22)	1-1/4 (32)
PB925A	–	–	27-1/4 (692)	1-1/2 (38)	6 (152)	9-1/8 (232)	28-3/4 (730)	2 @ 1/2 (13)	2 @ 7/8 (22)	1-1/4 (32)
PB1100A	–	–	27-1/4 (692)	1-1/2 (38)	6 (152)	9-1/8 (232)	28-3/4 (730)	2 @ 5/8 (16)	2 @ 1-1/8 (29)	1-1/4 (32)
PB1350A	9-1/4 (235)	27-1/2 (699)	29-1/2 (749)	6 (152)	6 (152)	–	–	2 @ 5/8 (16)	2 @ 1-1/8 (29)	1-1/4 (32)

Table 18 Piggyback condenser approximate refrigerant charges

Model	lb (kg) per circuit
PB350A	19 (8.6)
PB550A	18 (8.2)
PB675A	26 (11.8)
PB925A	23 (10.4)
PB1100A	36 (16.3)
PB1350A	36 (16.3)

3.4 Fan Speed Control Systems

Fan Speed Control provides an infinite number of speed variations on specially designed permanent split-capacitor motors. The control module varies the air quantity passing over the condenser coil by monitoring refrigerant pressure.

3.4.1 Materials Supplied

- Built-in, pre-wired condenser control box
- Air cooled condenser
- Piping access cover to be reinstalled when piping is complete
- Bolts – four per leg (3/8"x5/8")
- Terminal block for two-wire, 24V interlock connection between unit and condenser
- Condenser legs – four with 1-fan, 2-fan and 3-fan models; six with 4-fan models

3.4.2 Dehydration

1. Open all disconnect switches.
2. Pull all fuses except transformer fuses. On units supplied with circuit breakers, open all breakers except for the transformer.
3. Turn disconnects ON and jumper Fan Safety Switch between Common and Normal Open.
4. To energize the solenoid valves, use manual override jumpers (on SM). On AM and AG, set the temperature set point (see operation manual) to 60°F (15°C) to ensure that solenoid valves are open during the dehydration procedure.
5. Connect refrigeration gauges to the suction and discharge service valves of compressors 1 & 2.
6. Open all service valves.

Connect refrigerant gauges to both the suction and discharge service valves of the compressors. Starting with circuit #1, open the service valves and place 150 PSIG (1034 kPa) of dry nitrogen with a tracer of Freon. Check system for leaks.

With pressure in circuit: #1, open the service valves in circuit #2. If pressure increases in circuit #2, the system is cross-circuited and must be rechecked for proper piping. If there is no pressure increase, repeat leak check procedure for circuit #2.

After completion of leak testing, release the test pressure and pull a vacuum on the system. Leave this vacuum for approximately 4 hours. Check the pressure to make sure that it has not increased. If there is no change in pressure, pull another vacuum to 250 microns or less. Recheck the pressure after two hours. After completion of this step, fill the circuits with Freon vapor until suction and discharge pressures have equalized.

3.4.3 Charging

Remove the reheat and humidifier fuses (or open circuit breakers). Remove all shipping blocks from the compressors and insure that all operational components are clear of debris. Turn the disconnect on and check the evaporator fan for proper rotation. Set the temperature set point (see Operation Manual) to 60°F (15°C) to ensure that solenoid valves are open during the charging procedure. Connect the refrigerant gauge charging hose to the drum of refrigerant and purge the hoses of non-condensables. Add refrigerant vapor to the suction side of the compressor to eliminate short-cycling. The low-pressure switch may be manually energized to expedite charging.

As head pressure builds the condenser fan will start rotating. The fan will become fully energized when sufficient head pressure is developed. Charge the unit until the liquid line sight glasses become clear. Watch the sight glasses for a period of 10 minutes to insure that no bubbles reappear. At this point, add additional refrigerant to the circuit so that 5-10°F (3-5°C) subcooling is obtained in each liquid line.

Table 19 Indoor unit approximate refrigerant charge lb (kg.) R–22

Model 60 Hz (50 Hz)	Refrigerant Charge/Circuit
75A	4.0 (1.8)
114A (115A)	5.0 (2.3)
125A (130A)	5.0 (2.3)
199A	6.0 (2.7)
245A	7.0 (3.2)
290A	7.0 (3.2)
380A	8.0 (3.6)

Table 20 Outdoor condenser approximate refrigerant charge lb (kg) per circuit

Model	Fan Speed Control	Lee-Temp (Includes Receiver)
097	5 (2.3)	27 (12.3)
108	6 (2.7)	33 (15.0)
130	5 (2.3)	27 (12.3)
104L	4 (1.8)	21 (9.5)
175	7 (3.2)	38 (17.2)
165L	5 (2.3)	27 (12.3)
205L	7 (3.2)	38 (17.2)
216	12 (5.4)	64 (29.0)
291	15 (6.8)	75 (34.0)
308L	11 (5.0)	58 (26.3)
349	22 (10.0)	113 (51.3)
408	20 (9.1)	101 (45.8)
415L	15 (6.8)	75 (34.0)
451	25 (11.3)	124 (56.3)
480C	20 (9.1)	101 (45.8)
488	30 (13.6)	149 (67.6)
510C	30 (13.6)	149 (67.6)
580	30 (13.6)	150 (68.0)
820	39 (17.7)	N/A
830L	30 (13.6)	149 (67.6)

Table 21 Liquid line charge lb/10 ft. (kg/.3m) R–22

Line Size, OD Cu	Charge
1/2”	.73 (.33)
5/8”	1.17 (.52)
7/8”	2.44 (1.09)
1-1/8”	4.16 (1.86)
1-3/8”	6.33 (2.83)
Total Charge per Circuit. (There are two circuits per system)	= Unit Charge + Condenser Charge + Liquid Line Charge

Table 22 Refrigerant control settings for air cooled units psi (kPa)

Model	Refrigerant Type	Low Pressure Cut Out	Low Pressure Cut In	High Pressure Cut Out
Fan Speed Control	R-22	15 (103.4)	35 (241.3)	360 (2482)
Lee-Temp	R-22	20 (137.9)	65 (448.2)	360 (2482)

3.5 Lee-Temp/Flood Back Head Pressure Control Systems

The Lee-Temp system consists of a modulating type head pressure control valve and insulated receivers with heater pads to ensure operation at ambient temperatures as low as -30°F (-34.4°C).

3.5.1 Piping

Be sure to install the valve with the refrigerant flow in the proper direction. When soldering or brazing the valves, it is very important that the internal parts be protected by wrapping the valve with a damp cloth to keep the valve temperature below 250°F (121°C).

3.5.2 Materials Supplied

- Built-in, pre-wired condenser control box
- Air cooled condenser
- Piping access cover to be reinstalled when piping is complete
- Bolts – four per leg (3/8"x5/8")
- Terminal block for two-wire, 24V interlock connection between the unit and the condenser
- Condenser legs: four on one-fan models, six on two- and three-fan models, and eight on four-fan models
- Lee-Temp system:
  - Insulated storage receiver – one per circuit
  - Head pressure control valve with integral check valve – one per circuit
  - Adapter assembly – one per circuit
  - Rotalock valve – one per circuit
  - Pressure relief valve – one per circuit
  - Liquid level sight glass – two per circuit
  - Check valve – one per circuit.
- Bolts – six per receiver (3/8" x 1")

NOTE
Lee-Temp heater pads require a separate, continuous electrical source of either 115 VAC or 200/208/230 VAC.

3.5.3 Dehydration

1. Open all disconnect switches.
2. Pull all fuses except transformer fuses. On units supplied with circuit breakers, open all breakers except for the transformer.
3. Jumper Fan Safety Switch between Common and Normal Open. Turn disconnects ON.
4. Use the manual override switches to energize the solenoid valves.
5. Connect refrigeration gauges to the suction and discharge service valves of compressors 1 & 2.
6. Open all service valves.
7. Charge circuit #1 to 150 psig (1034 kPa) with dry nitrogen containing a tracer of Freon.
8. Check for pressure increase in circuit #2. This would indicate that the refrigeration circuits are cross-circuited and must be re-piped.
9. If there is no pressure increase, charge circuit #2 to 150 psig (1034 kPa) with dry nitrogen containing a tracer of Freon and leak-test both circuits.
10. After completion of leak testing, release test pressure and pull a vacuum on both circuits.
11. After 4 hours, check gauge readings and, if they have not changed, purge with Freon.
12. Pull a second and third vacuum of 250 microns (29.84 in. Hg), leave for 2 hours and recheck gauges.

3.5.4 Charging

1. Make sure unit is OFF and that jumper is removed on Fan Safety Switch.
2. Connect a set of manifold gauges to the refrigerant drum and to the receiver at the rotalock valve. Purge the hoses.
3. Open the rotalock valve and fill the receiver with liquid refrigerant per **Table 26**.
4. Close the valve and disconnect gauges.
5. Start the compressor and recheck the refrigerant level. If the level has dropped, recharge with vapor through the suction port.
6. Replace all fuses (or close circuit breakers) except reheat and humidifier.
7. Connect refrigerant charging hose to suction port of compressors and purge with Freon.
8. To energize the solenoid valves, use manual override jumpers (on SM) or test outputs (on AM and AG).
9. Charge with vapor until the refrigerant level is in accordance with **3.5.5 - Refrigerant Level**.

3.5.5 Refrigerant Level

On each receiver at the condenser are two refrigerant-level sight glasses. Refrigerant level will vary with outside temperature.

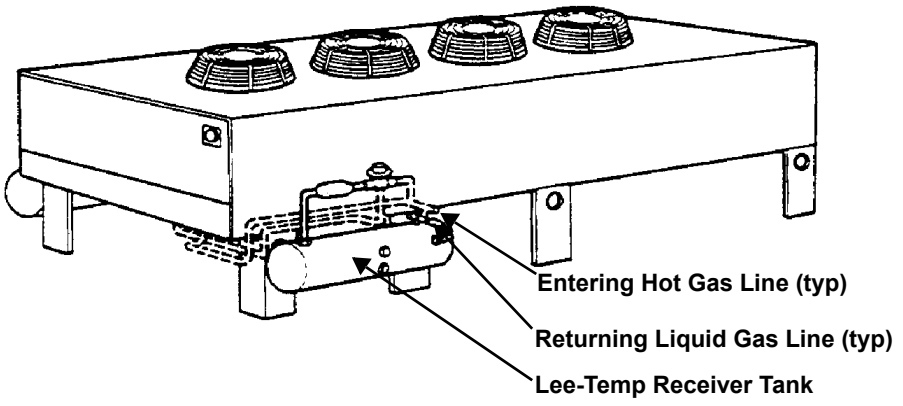
Check refrigerant level after the unit has been on for at least 15 minutes.

40°F (4.5°C) and below
Bottom sight glass is 3/4 full

40°F to 60°C (4.5°C to 15.5°C)
Bottom sight glass is full

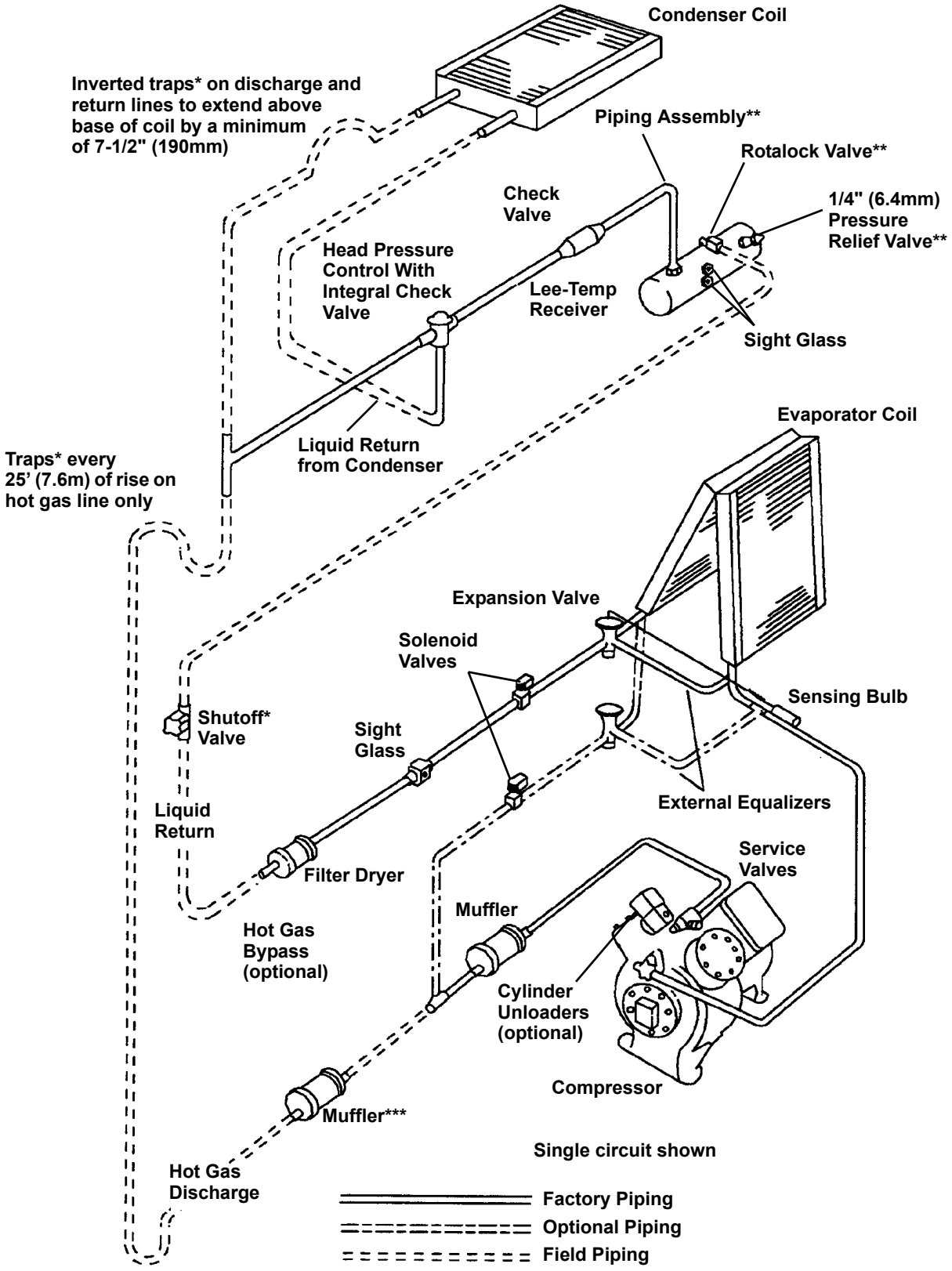
60°F (15.5°C) and above
Top sight glass is 3/4 full

Figure 22 Lee-Temp control condenser



NOTE
The following materials are supplied by Liebert for each circuit (shipped loose with condenser) for field installation: insulated Lee-Temp storage tank, head pressure control valve, check valve, rotalock valve, two sight glasses and a pressure relief valve. All other piping to be supplied and installed by others.

Figure 23 Lee-Temp control typical general arrangement diagram



* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance

** Components supplied by Liebert and must be field-installed

*** Components supplied by Liebert and must be field-installed (DH/VH and DE/VE 245A, 290A and 380A models only)

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4.0 GLYCOL COOLED/GLYCOOL™ MODELS

4.1 Drycooler Location

4.1.1 Outdoor Prop Fan Models

The drycooler should be located for maximum security and maintenance accessibility. Avoid ground-level sites with public access or areas that contribute to heavy snow or ice accumulations. To assure adequate air supply, it is recommended that drycoolers be located in a clean air area, away from loose dirt and foreign matter that may clog the coil. In addition, drycoolers should not be located in the vicinity of steam, hot air or fume exhausts. Also, drycoolers should not be located closer than 3 feet (1 meter) from a wall, obstruction or adjacent unit.

4.1.2 Indoor Piggyback Models

The Piggyback drycooler can be located directly behind the Deluxe unit or in a separate remote indoor location. It may be placed directly against an outside wall, with the proper openings cut in the wall for entering and leaving air. If it cannot be located near a wall, the unit may be ducted to the outside. Proper grills/screens are required on the outside wall.

4.2 Drycooler Installation

For roof installation, mount drycoolers on steel supports in accordance with local codes. To minimize sound and vibration transmission, mount steel supports across load bearing walls. For ground installation, a concrete pad will provide adequate support. Drycooler legs have mounting holes for securing the drycooler to steel supports or concrete pad.

4.3 Electrical Connections

4.3.1 High Voltage

High voltage electrical service is required for all drycoolers at the location of the drycooler. This power supply does not have to be the same voltage as the indoor unit. This separate power source may be 208, 230, 460 or 575 Volt 60 Hertz; or 200, 230 or 400 Volt 50 Hertz. The disconnect switch is factory supplied and mounted in the electric panel.

4.3.2 Low Voltage

A control interlock between the drycooler and the indoor unit is required and is connected between 70 &71 on the wire raceway in the compressor compartment of the indoor unit and the pump and drycooler control box of the drycooler.

4.3.3 Pump And Drycooler

All wiring to the pump and drycooler from the control box should be done in accordance with the electrical schematic on the inside lid of the drycooler control box and with local and national codes (on Piggyback Models, the pump is located within the drycooler).

4.4 Glycol Piping

Manual shut-off valves should be installed at the supply and return line to each indoor unit and drycooler. This will provide for routine service or emergency isolation of the unit.

To provide for the emergency of water leaks and the consequences of subfloor flooding, floor drains should be provided with wet traps or a water detection system such as a Liqui-Tect that should be installed near the base of the unit or below the elevated floor.

The temperature of the glycol supplied by the drycooler will determine whether the glycol supply and return lines should be insulated to prevent condensation.

Table 23 Room dew point temperatures °F (°C)

Dry Bulb	Wet Bulb	Relative Humidity	Dew Point
70 (21.1)	57.2 (14.0)	45	48.9 (8.9)
70 (21.1)	58.5 (14.7)	50	50.5 (10.3)
72 (22.2)	58.9 (14.9)	45	50.0 (10.0)
72 (22.2)	60.0 (15.5)	50	52.4 (11.3)
75 (23.8)	61.2 (16.2)	45	52.4 (11.3)
75 (23.8)	62.5 (16.9)	50	55.0 (12.7)

*Minimum glycol temperature before condensation will occur.

Table 24 Glycol concentration

% Glycol by Volume	0	10	20	30	40	50
Freezing Point °F (°C)	32 (0)	25 (-3.9)	16 (-8.9)	5 (-15.0)	-10 (-23.3)	-32 (-35.5)
Apparent specific Gravity @ 50°F (10°C)	1.000	1.014	1.028	1.042	1.057	1.071

Table 25 Refrigerant control settings for glycol cooled units—psi (kPa)

Refrigerant Type	Low Pressure Cut Out	Low Pressure Cut In	High Pressure Cut Out
R–22	20 (137.9)	65 (448.2)	360 (2482)

Table 26 Deluxe glycol volume approximate gal. (l) max

Model (50 Hz)	Glycol Cooled	GLYCOOL	
		Upflow	Downflow
—72G	2.0 (7.5)	9.0 (34.0)	8.5 (32.0)
—110G/(111G)	2.0 (7.5)	9.0 (34.0)	8.5 (32.0)
—116G/(121G)	2.5 (9.5)	10.0 (38.0)	10.0 (38.0)
—192G	4.5 (17.0)	14.0 (53.0)	13.5 (51.0)
—240G	5.5 (21.0)	15.0 (57.0)	15.0 (57.0)
—265G	5.5 (21.0)	–	–
—363G	6.5 (24.6)	18.0 (68.1)	18.0 (68.1)

Table 27 Volume in standard Type L copper piping

Diameter (in.)		Volume	
Outside	Inside	gal./ft.	l/m
1/2	0.123	0.008	0.01
5/8	0.545	0.012	0.15
3/4	0.666	0.018	0.22
7/8	0.785	0.025	0.31
1-1/8	1.025	0.043	0.53
1-3/8	1.265	0.065	0.81
1-5/8	1.505	0.092	1.15
2-1/8	1.985	0.161	2.00
2-5/8	2.465	0.248	3.08
3-1/8	2.945	0.354	4.40
3-5/8	3.425	0.479	5.95
4-1/8	3.905	0.622	7.73

Figure 24 Downflow glycol cooled (DH) piping connections

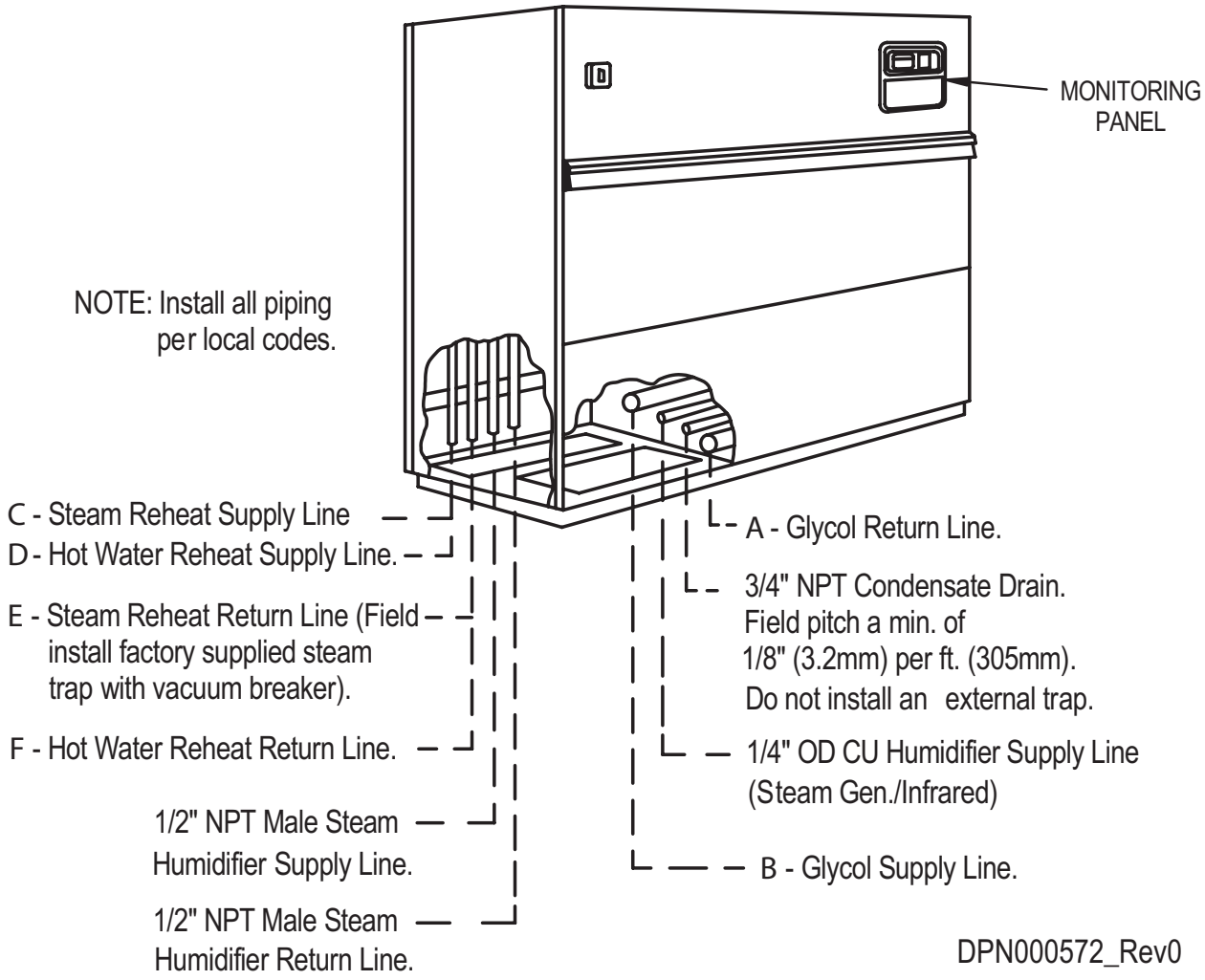

MONITORING PANEL
NOTE: Install all piping per local codes.
C - Steam Reheat Supply Line
D - Hot Water Reheat Supply Line.
E - Steam Reheat Return Line (Field install factory supplied steam trap with vacuum breaker).
F - Hot Water Reheat Return Line.
1/2" NPT Male Steam Humidifier Supply Line.
1/2" NPT Male Steam Humidifier Return Line.
A - Glycol Return Line.
3/4" NPT Condensate Drain. Field pitch a min. of 1/8" (3.2mm) per ft. (305mm). Do not install an external trap.
1/4" OD CU Humidifier Supply Line (Steam Gen./Infrared)
B - Glycol Supply Line.
DPN000572_Rev0

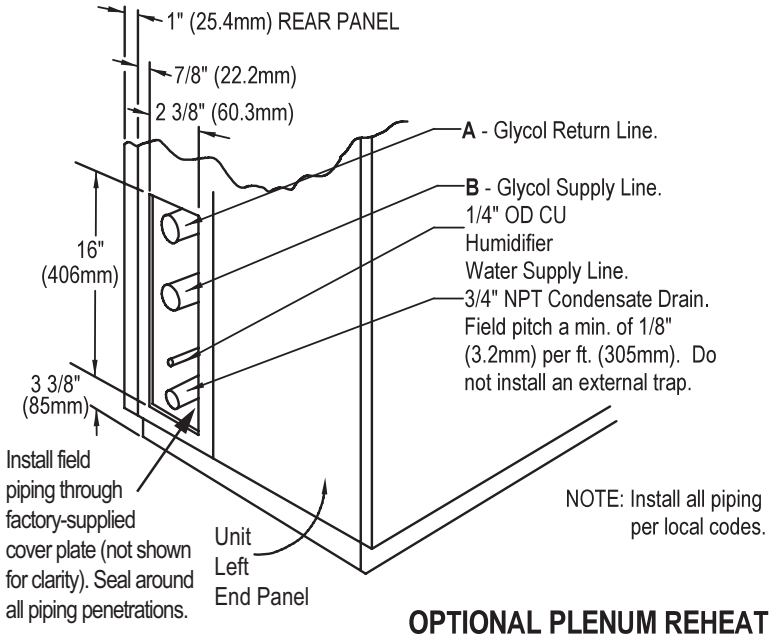
Table 28 Downflow glycol cooled (DH) piping connection sizes, inches

Glycol Cooled Models 60 Hz (50 Hz)	A (OD CU)	B (OD CU)	C (NPT Male)	D (OD CU)	E (NPT Male)	F (OD CU)
DH072G (DH072G)	1-5/8	1-5/8	1/2	5/8	1/2	5/8
DH110G (DH111G)						
DH116G (DH121G)						
DH192G (DH192G)	2-1/8	2-1/8	3/4	7/8	3/4	7/8
DH240G (DH240G)						
DH265G (DH265G)			NA	NA	NA	NA
DH363G (DH363G)						

Figure 25 Upflow glycol cooled (VH) piping connections

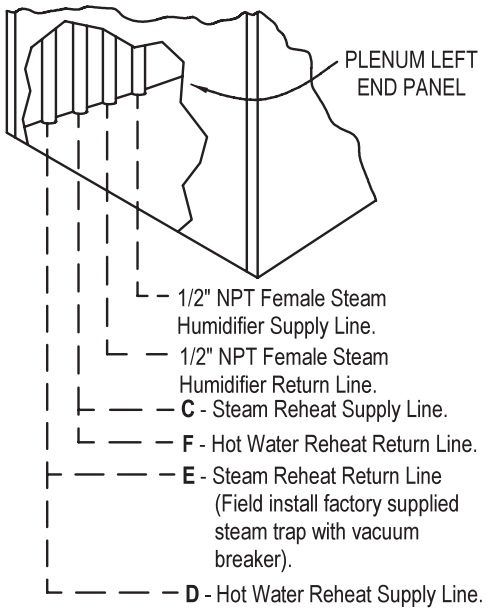
UNIT CONNECTION LOCATIONS

Piping stubbed out inside unit end compartment for field connection through 2 3/8" x 16" (60.3 x 406mm) opening as shown. Piping is recessed inside the unit and not flush as indicated. Piping may also exit through bottom of end compartment by field cutting an opening in a suitable location (except bottom return air units).

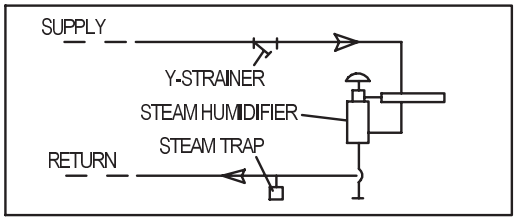

1" (25.4mm) REAR PANEL
7/8" (22.2mm)
2 3/8" (60.3mm)
A - Glycol Return Line.
B - Glycol Supply Line. 1/4" OD CU Humidifier Water Supply Line.
3/4" NPT Condensate Drain. Field pitch a min. of 1/8" (3.2mm) per ft. (305mm). Do not install an external trap.
16" (406mm)
3 3/8" (85mm)
Install field piping through factory-supplied cover plate (not shown for clarity). Seal around all piping penetrations.
Unit Left End Panel
NOTE: Install all piping per local codes.

PLENUM CONNECTION LOCATIONS

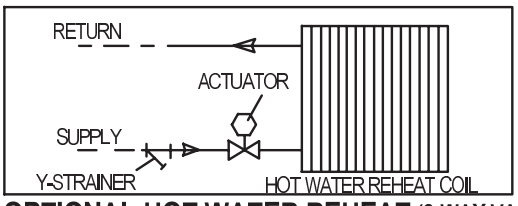
For seperate steam or hot water plenum UPFLOW (VH) units, piping may exit through bottom, top or sides by field cutting an opening in a suitable location.


PLENUM LEFT END PANEL
1/2" NPT Female Steam Humidifier Supply Line.
1/2" NPT Female Steam Humidifier Return Line.
C - Steam Reheat Supply Line.
F - Hot Water Reheat Return Line.
E - Steam Reheat Return Line (Field install factory supplied steam trap with vacuum breaker).
D - Hot Water Reheat Supply Line.

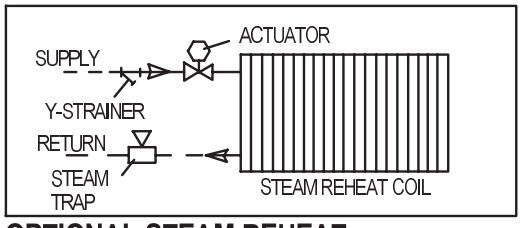
OPTIONAL PLENUM REHEAT SCHEMATICS



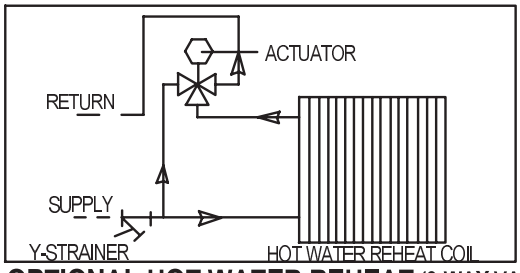
OPTIONAL STEAM HUMIDIFIER



OPTIONAL HOT WATER REHEAT (2-WAY VALVE)



OPTIONAL STEAM REHEAT



OPTIONAL HOT WATER REHEAT (3-WAY VALVE)

DPN00573 Rev0

Table 29 Factory-provided piping connection sizes, inches, upflow glycol cooled (VH)

Glycol Cooled Models		A	B	C	D	E	F
50 Hz	60 Hz	OD Cu	OD Cu	NPT Female	OD Cu	NPT Female	OD Cu
VH-072G	VH-072G	1-5/8	1-5/8	1/2	5/8	1/2	5/8
VH-111G	VH-110G	1-5/8	1-5/8	1/2	5/8	1/2	5/8
VH-121G	VH-116G	1-5/8	1-5/8	1/2	5/8	1/2	5/8
VH-192G	VH-192G	2-1/8	2-1/8	3/4	7/8	3/4	7/8
VH-240G	VH-240G	2-1/8	2-1/8	3/4	7/8	3/4	7/8
VH-265G	VH-265G	2-1/8	2-1/8	NA	NA	NA	NA
VH-363G	VH-363G	2-1/8	2-1/8	NA	NA	NA	NA

Figure 26 Downflow GLYCOOL™ cooled (DE) piping connections

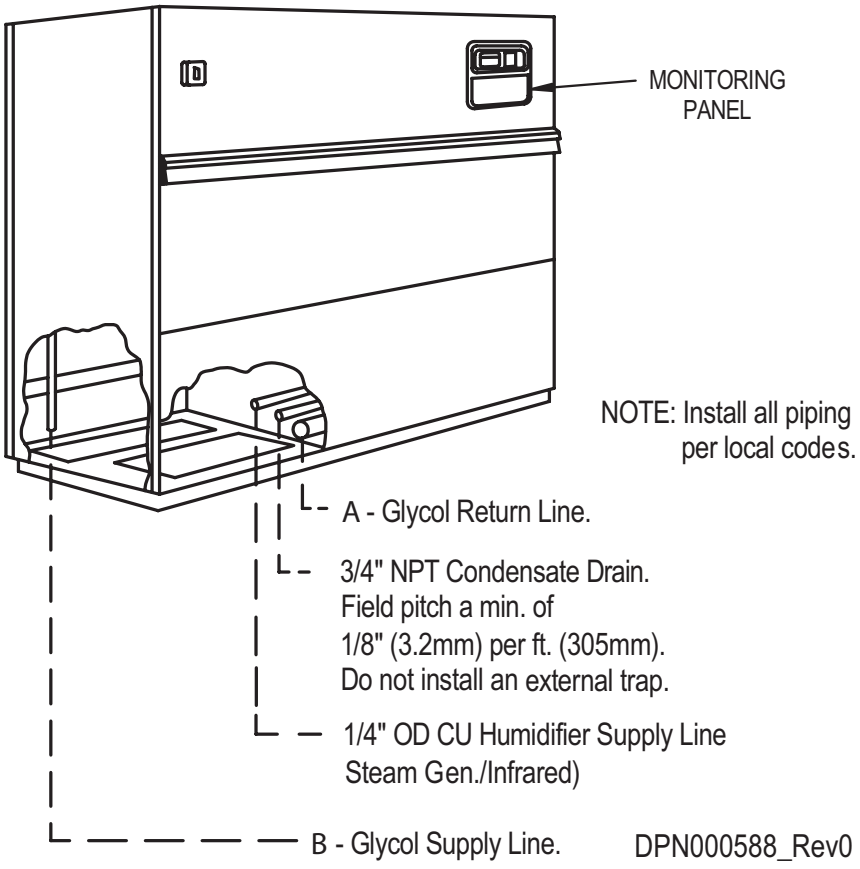


Table 30 Downflow GLYCOOL (DE) piping connection sizes, inches

GLYCOOL Models 60 Hz (50 Hz)	A (OD CU)	B (OD CU)
DE072G (DE072G)	1-5/8	1-5/8
DE110G (DE111G)		
DE116G (DE121G)		
DE192G (DE192G)	2-1/8	2-1/8
DE240G (DE240G)		
DE363G (DE363G)		

Figure 27 Upflow GLYCOOL™ cooled (VE) piping connections

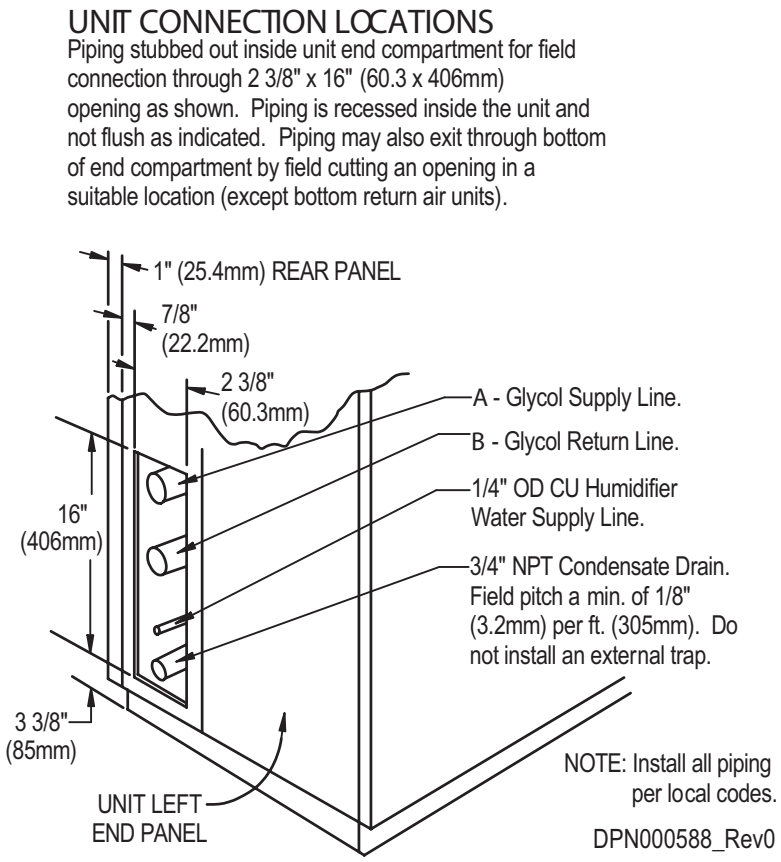

UNIT CONNECTION LOCATIONS
Piping stubbed out inside unit end compartment for field connection through 2 3/8" x 16" (60.3 x 406mm) opening as shown. Piping is recessed inside the unit and not flush as indicated. Piping may also exit through bottom of end compartment by field cutting an opening in a suitable location (except bottom return air units).
1" (25.4mm) REAR PANEL
7/8" (22.2mm)
2 3/8" (60.3mm)
A - Glycol Supply Line.
B - Glycol Return Line.
1/4" OD CU Humidifier Water Supply Line.
3/4" NPT Condensate Drain. Field pitch a min. of 1/8" (3.2mm) per ft. (305mm). Do not install an external trap.
16" (406mm)
3 3/8" (85mm)
UNIT LEFT END PANEL
NOTE: Install all piping per local codes.
DPN000588_Rev0

Table 31 Upflow GLYCOOL (VE) piping connection sizes, inches

GLYCOOL Models 60 Hz (50 Hz)	A (OD Cu)	B (OD Cu)
VE072G (VE072G)	1-5/8	1-5/8
VE110G (VE111G)		
VE116G (VE121G)		
VE192G (VE192G)	2-1/8	2-1/8
VE240G (VE240G)		
VE363G (VE363G)		

Figure 28 1-4 fan drycooler cabinet and anchor dimensional data

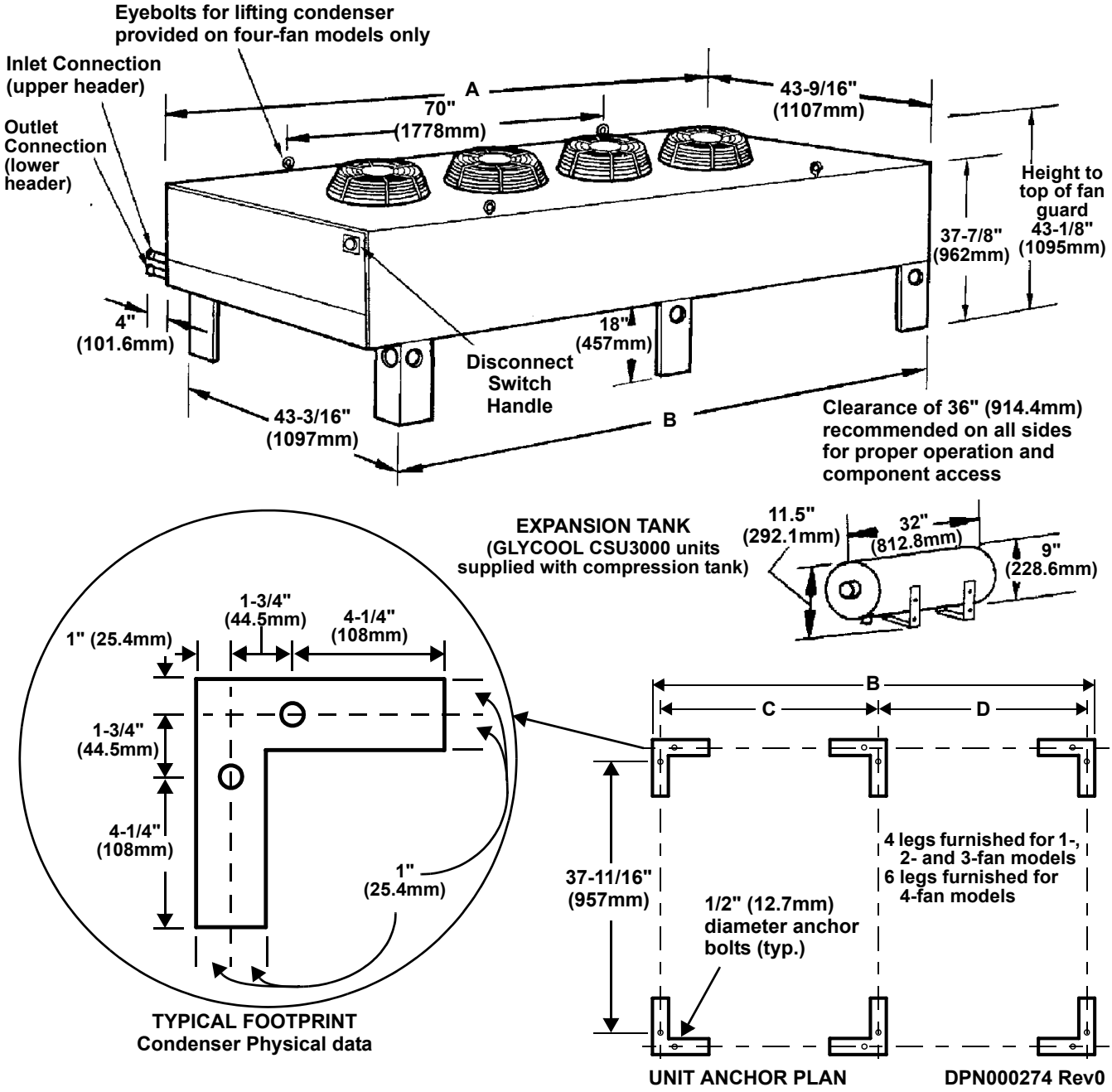


Table 32 Glycol pump data

Pump		Pump Suction Connection in.	Pump Discharge Connection in.
Hp	Hz		
1-1/2	60	1-1/4	3/4
2	60		
3	60	1-1/2	1
5	60		1-1/4
1	50	1-1/4	3/4
2	50		
3	50	1-1/2	1-1/4

Note: Connection sizes apply to primary pump supplier.

Table 33 1-4 fan drycooler physical data

Model (Notes 2,3,4)	# of Fans	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	CFM (l/s) 60 Hz[1]	CFM (l/s) 50 Hz[1]	Internal Volume gal. (l)	Net Weight lb (kg)	Piping Connection Sizes Inlet in. (mm)	Piping Connection Sizes Outlet in. (mm)
-033	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	7200 (3398)	6000 (2932)	1.2 (4.6)	390 (177)	3/4 (19.1)	3/4 (19.1)
-069	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	6866 (3240)	5722 (2700)	2.4 (9.2)	410 (186)	1-1/4 (31.8)	1-1/4 (31.8)
-092	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	6633 (3130)	5527 (2609)	3.7 (13.9)	430 (195)	1-1/2 (38.1)	1-1/2 (38.1)
-109	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	6322 (2984)	5268 (2486)	4.9 (18.6)	450 (204)	2 (50.8)	2 (50.8)
-112	1	51-1/2 (1308)	44 (1118)	42 (1067)	–	6088 (2873)	5074 (2394)	5.8 (22.0)	470 (213)	2 (50.8)	2 (50.8)
-139	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	13732 (6481)	11443 (5401)	4.8 (18.2)	565 (256)	2 (50.8)	2 (50.8)
-174	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	13265 (6261)	11054 (5217)	6.9 (26.2)	605 (274)	2 (50.8)	2 (50.8)
-197	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	12645 (5968)	10535 (4973)	9 (34)	645 (293)	2 (50.8)	2 (50.8)
-225	2	91-1/2 (2324)	84 (2134)	82 (2083)	–	12177 (5748)	10147 (4789)	11.1 (42.1)	685 (310)	2 (50.8)	2 (50.8)
-260	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	19898 (9392)	16582 (7827)	10.0 (37.8)	826 (375)	2 (50.8)	2 (50.8)
-310	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	18965 (8951)	15804 (7459)	13.1 (50.0)	886 (402)	2 (50.8)	2 (50.8)
-350	3	131-1/2 (3340)	124 (3150)	122 (3099)	–	17398 (8218)	14499 (6843)	19.4 (65.9)	946 (429)	2 (50.8)	2 (50.8)
-352	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	24800 (11705)	20667 (9755)	13.1 (49.6)	1040 (471)	2 (50.8)	2 (50.8)
-419	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	23650 (11163)	19708 (9302)	17.4 (65.9)	1120 (508)	2 (50.8)	2 (50.8)
-466	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	22770 (10747)	18975 (8956)	22.0 (83.3)	1150 (522)	2-1/2 (63.5)	2-1/2 (63.5)
-491	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	21700 (10242)	18083 (8535)	26.3 (99.6)	1200 (544)	2-1/2 (63.5)	2-1/2 (63.5)

1. All drycooler fan motors are 3/4 HP.
2. DSO model prefix indicates control section in drycooler includes controls for a single pump package. DDO model prefix indicates control section in drycooler includes controls for a dual pump package. DSF model prefix indicates control section in drycooler includes controls for a single pump package on a fan speed control drycooler.
3. DNT prefix indicates a single circuit with fan cycling but no pump controls.
4. DNC prefix indicates a single circuit with no fan or pump controls.

Figure 29 6- and 8-fan drycooler cabinet and anchor dimensional data

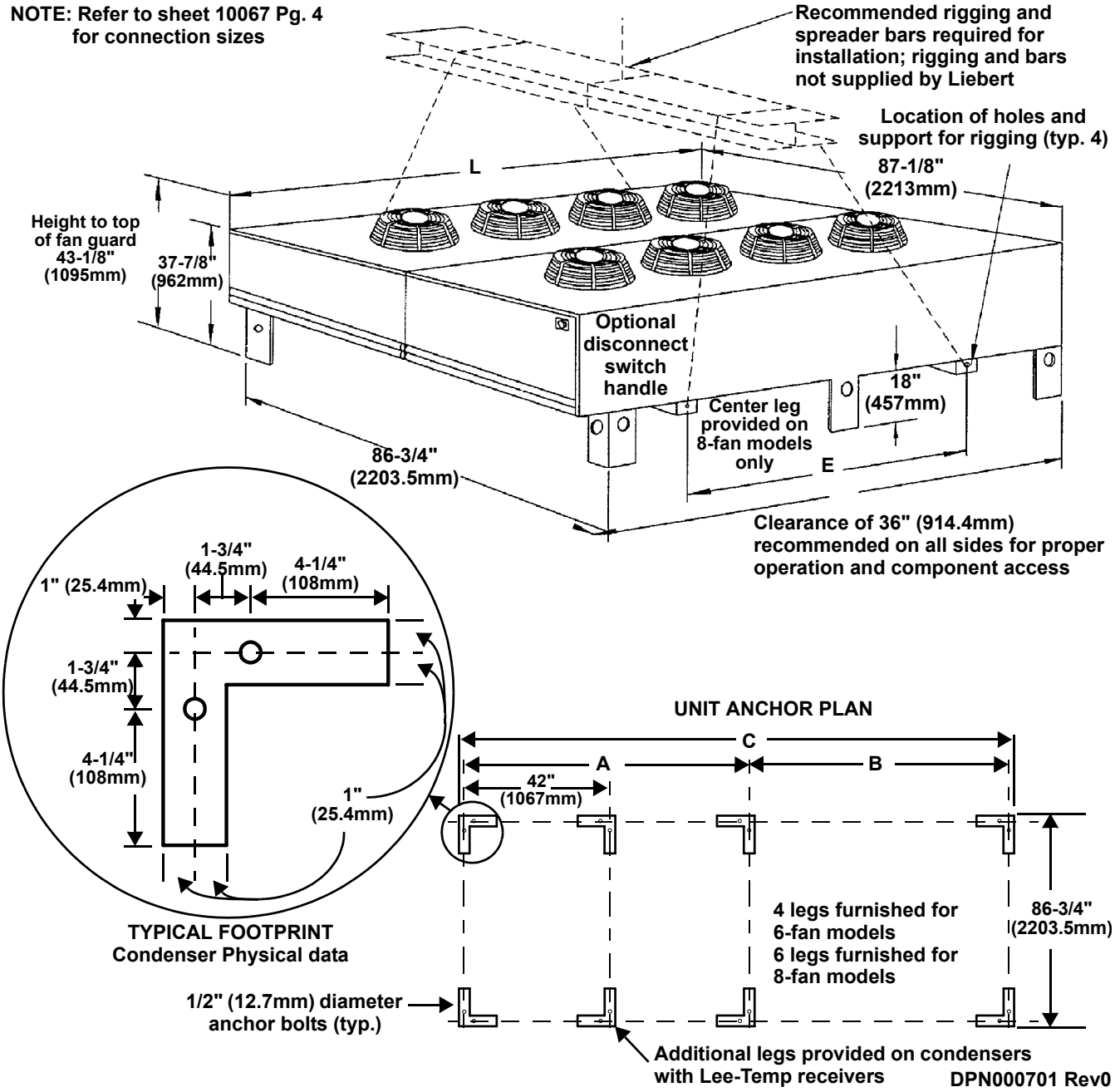

NOTE: Refer to sheet 10067 Pg. 4 for connection sizes
Recommended rigging and spreader bars required for installation; rigging and bars not supplied by Liebert
Location of holes and support for rigging (typ. 4)
87-1/8" (2213mm)
L
Height to top of fan guard 43-1/8" (1095mm)
37-7/8" (962mm)
Optional disconnect switch handle
18" (457mm)
Center leg provided on 8-fan models only
E
86-3/4" (2203.5mm)
Clearance of 36" (914.4mm) recommended on all sides for proper operation and component access
1-3/4" (44.5mm)
4-1/4" (108mm)
1" (25.4mm)
1-3/4" (44.5mm)
4-1/4" (108mm)
1" (25.4mm)
TYPICAL FOOTPRINT
Condenser Physical data
UNIT ANCHOR PLAN
C
A
B
42" (1067mm)
4 legs furnished for 6-fan models
6 legs furnished for 8-fan models
86-3/4" (2203.5mm)
1/2" (12.7mm) diameter anchor bolts (typ.)
Additional legs provided on condensers with Lee-Temp receivers
DPN000701 Rev0

Table 34 6- and 8-fan drycooler physical data

Model	# of Fans	A	B	C	E	L	CFM (l/s) 60 Hz	CFM (l/s) 50 Hz	Coil Internal Volume gal. (l)	Net Weight lb (kg)	Piping Connection Sizes	
		in (mm)	in (mm)	in (mm)	in (mm)	in (mm)					Inlet in. (mm)	Outlet in. (mm)
-620	6	122 (3099)	–	124 (3150)	59 (1499)	131-1/2 (3340)	37900 (17889)	31600 (14915)	27.0 (102.2)	1940 (880)	2-1/8 (54)	2-1/8 (54)
-650	6	122 (3099)	–	124 (3150)	59 (1499)	131-1/2 (3340)	36500 (17228)	30400 (14349)	33.0 (124.9)	2000 (907.2)	2-1/8 (54)	2-1/8 (54)
-700	6	122 (3099)	–	124 (3150)	59 (1499)	131-1/2 (3340)	34800 (16426)	29000 (13688)	40.0 (151.4)	2060 (934.4)	2-1/8 (54)	2-1/8 (54)
-790	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	47300 (22326)	39400 (18597)	35.0 (132.5)	2550 (1157)	2-1/8 (54)	2-1/8 (54)
-880	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	45500 (21476)	37900 (17889)	44.0 (166.5)	2730 (1238.3)	2-1/8 (54)	2-1/8 (54)
-940	8	82 (2083)	80 (2032)	164 (4166)	70 (1778)	171-1/2 (4356)	43400 (20485)	36200 (17086)	52.0 (196.8)	2910 (1320)	2-1/8 (54)	2-1/8 (54)

4.5 Preparation of Glycol Solutions

Typical ethylene glycol manufacturers and suppliers are Union Carbide (Ucartherm) or Dow Chemical Company (Dowtherm SR-1). These ethylene glycols are supplied with an inhibitor and do not contain an anti-leak formula.

NOTE
For glycol solution preparation and periodic testing, follow manufacturer's recommendations. Do not mix products of different manufacturers.

CAUTION
Automotive antifreeze is unacceptable and must NOT be used.

Commercial ethylene glycol, when pure, is generally less corrosive to the common metals of construction than water itself. Aqueous solutions of these glycols, however, assume the corrosivity of the water from which they are prepared and may become increasingly corrosive with use if not properly inhibited.

There are two basic types of corrosion inhibition; they are classified as corrosion inhibitors or environmental stabilizers. The corrosion inhibitors function by forming a surface barrier that protects the metals from attack. Environmental stabilizers, while not corrosion inhibitors in the strict sense of the word, decrease corrosion by stabilizing or favorably altering the overall environment. An alkaline buffer, such as borax, is a simple example, since its prime purpose is to maintain an alkaline condition (pH above 7).

The quality of the water used for dilution must be considered because water may contain corrosive elements which reduce the effectiveness of the inhibited formulation. Preferably, surface water that is classified as soft (low in chloride and sulfate ion content—less than 100 parts per million each) should be used. Before an inhibited glycol solution is charged into a new or old system, residual contaminants such as sludge, rust, brine deposits, oil, etc., should be flushed out as completely as possible. Avoid the use of strong acid cleaners. However, if they are required, inhibited acids should be considered. In any event, assure that the cleaning agent is completely removed before charging with glycol. Contact Liebert Customer Service and Support for additional recommendations.

CAUTION
Galvanized pipe must not be used in glycol systems.

Figure 30 Glycol general arrangement

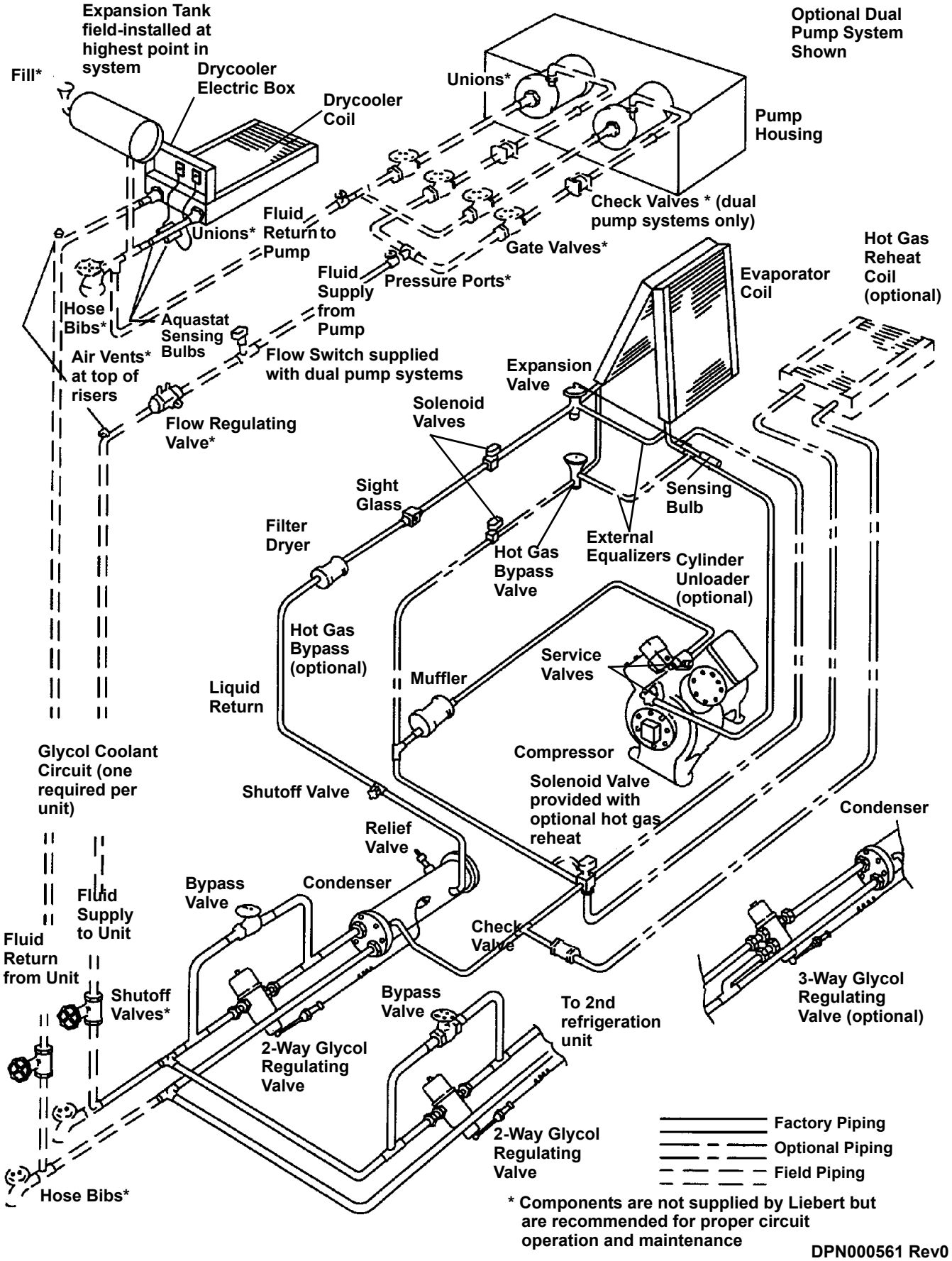
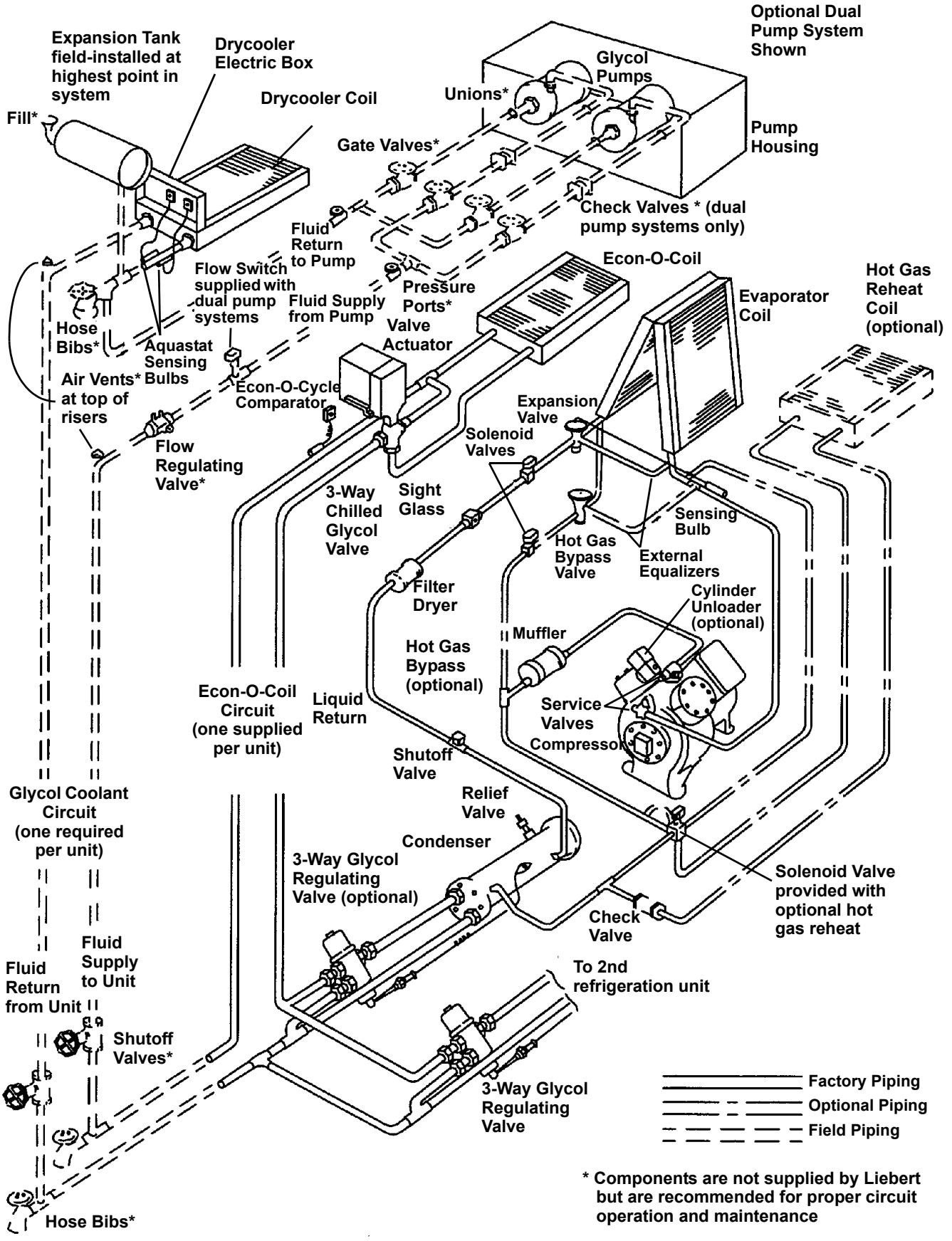


Figure 31 GLYCOOL™ general arrangement



5.0 WATER COOLED MODELS

5.1 Piping Considerations

Manual shut-off valves should be installed at the supply and return lines of each unit. This will provide for routine maintenance or emergency isolation of the unit.

When the water source for the condenser is of poor quality, it is good practice to provide cleanable filters in the supply line. These filters will trap the particles in the water supply and extend the service life of the water-cooled condenser.

To provide for the emergency of water leaks and the consequences of sub-floor flooding, floor drains should be provided with wet traps or a water detection system such as a Liqui-Tect sensor that is installed near the base of the unit or below the elevated floor.

5.2 Condenser

The condenser is designed to operate in conjunction with either a cooling tower or city water.

5.3 Water Regulating Valve

Water regulating valves automatically open on refrigerant pressure increase and close on pressure decrease.

To adjust the head pressure, attach refrigeration gauges to the compressor discharge and suction service valves. Raise the head pressure by turning the adjusting screw counterclockwise. Lower the head pressure by turning the adjusting screw clockwise. Allow enough time between changes for the system to stabilize.

5.3.1 Testing Valve Function

When the refrigeration system has been off for approximately 10-15 minutes, the water flow should stop.

Should the water continue to flow, the valve is either improperly adjusted or the pressure sensing capillary is not connected properly to the condenser.

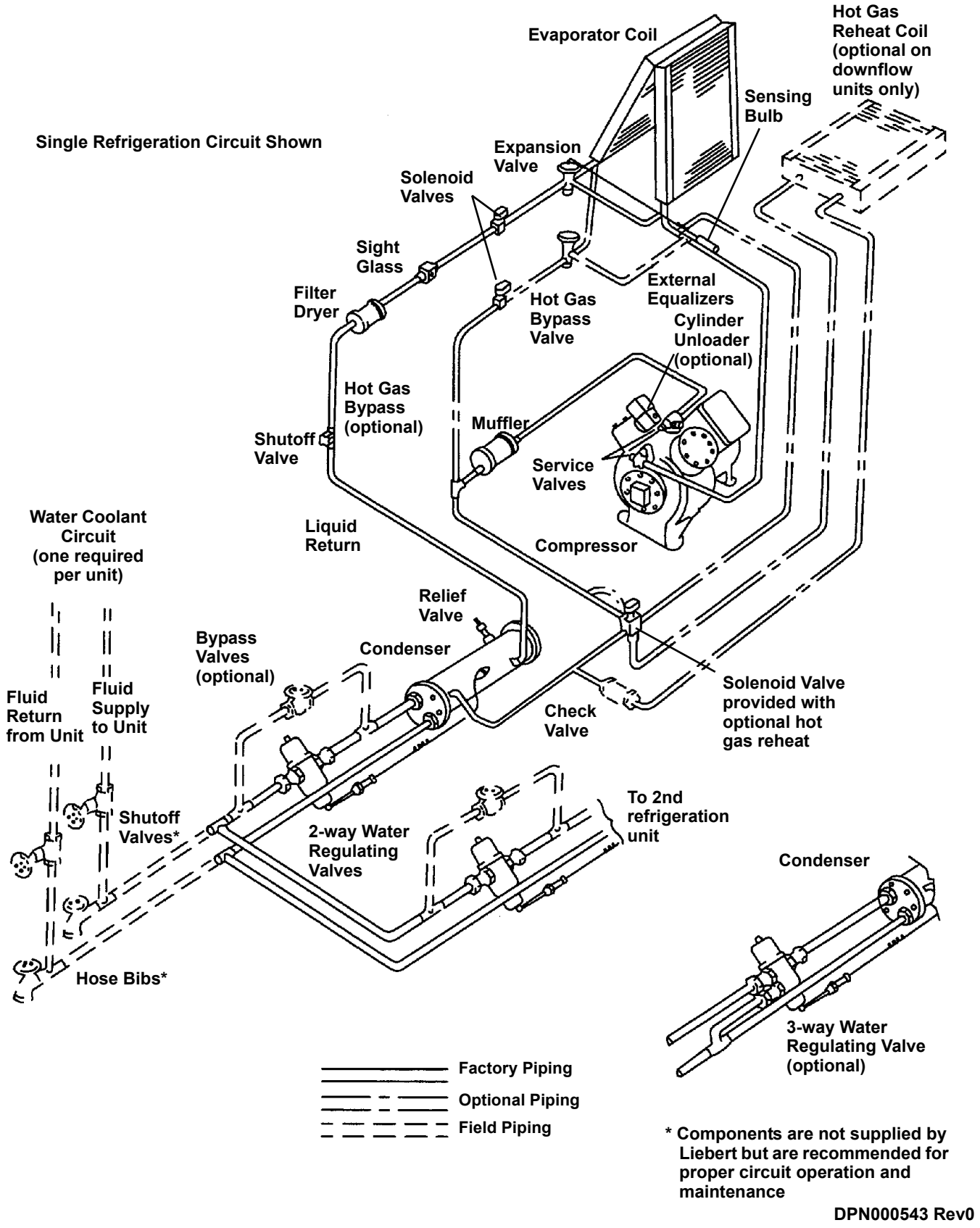
5.3.2 Manual Flushing

The valve may be flushed by inserting a screwdriver or similar tool under the two sides of the main spring and lifting. This action will open the valve seat and flush any dirt particles from the seat.

Table 35 Refrigerant control settings for water cooled units—psi (kPa)

Refrigerant Type	Low Pressure Cut Out	Low Pressure Cut In	High Pressure Cut Out
R–22	20 (137.9)	65 (448.2)	360 (2482)

Figure 32 Water cooled general arrangement



* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance

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Figure 33 Downflow water cooled (DH) piping connections

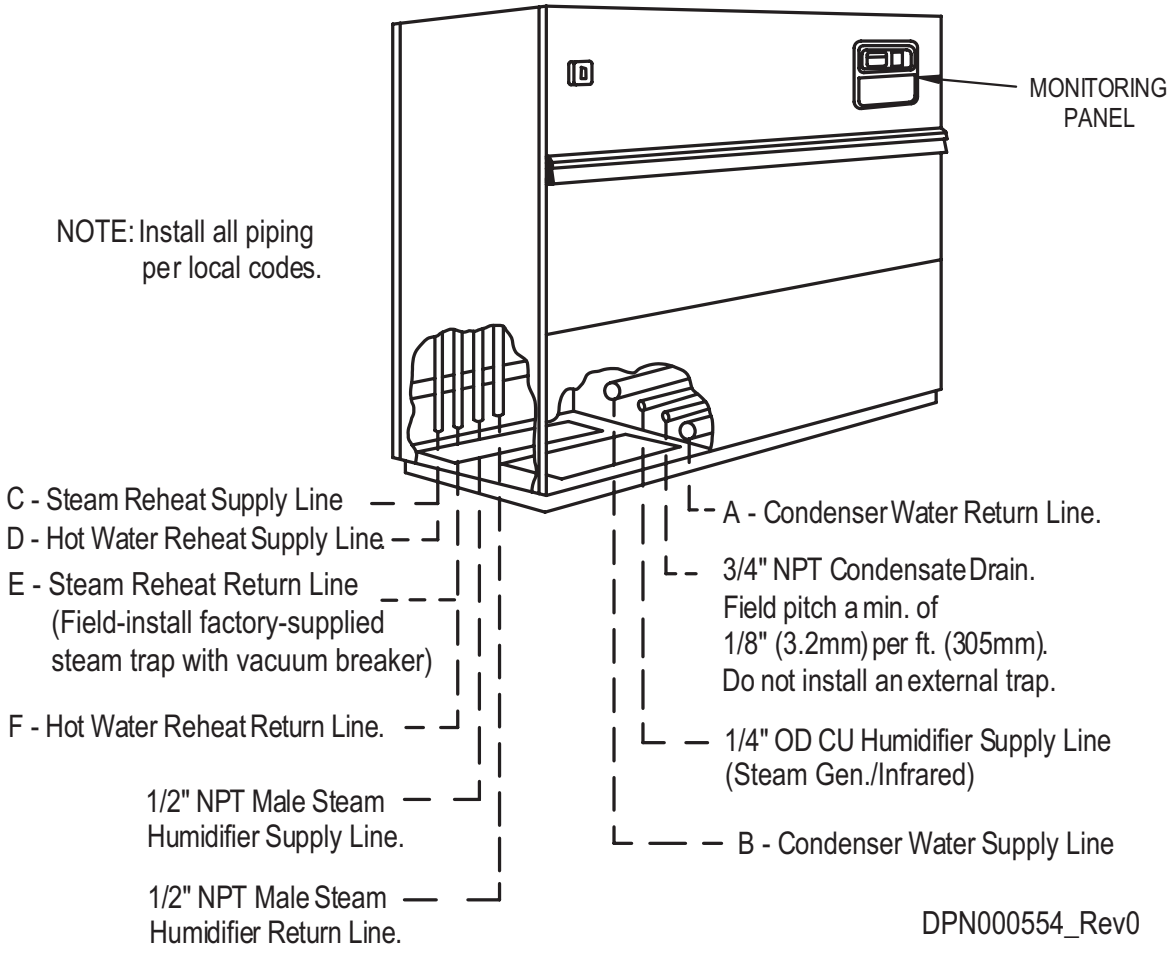
MONITORING PANEL
NOTE: Install all piping per local codes.
C - Steam Reheat Supply Line
D - Hot Water Reheat Supply Line.
E - Steam Reheat Return Line (Field-install factory-supplied steam trap with vacuum breaker)
F - Hot Water Reheat Return Line.
1/2" NPT Male Steam Humidifier Supply Line.
1/2" NPT Male Steam Humidifier Return Line.
A - Condenser Water Return Line.
3/4" NPT Condensate Drain. Field pitch a min. of 1/8" (3.2mm) per ft. (305mm). Do not install an external trap.
1/4" OD CU Humidifier Supply Line (Steam Gen./Infrared)
B - Condenser Water Supply Line
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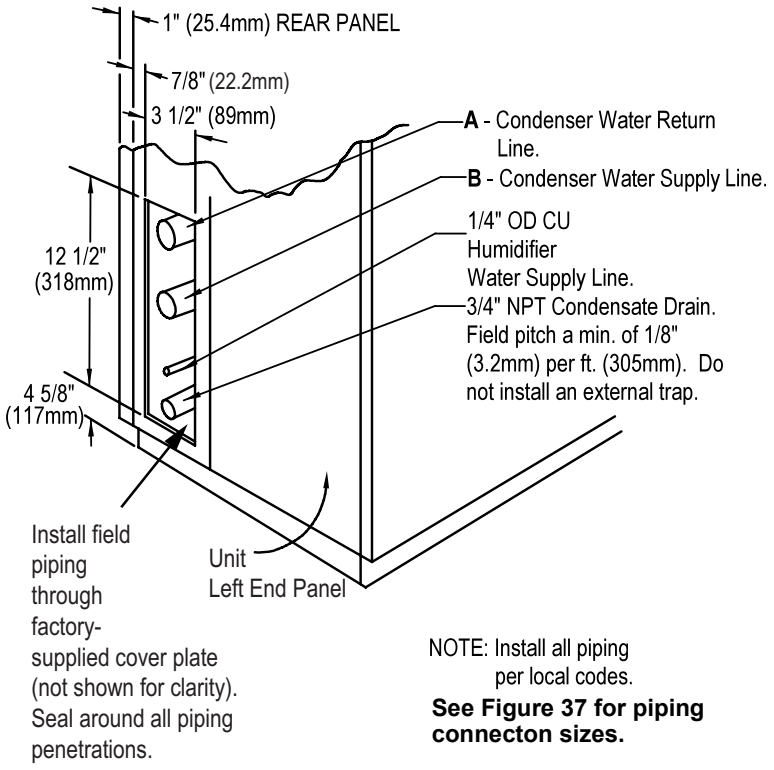
Table 36 Downflow water cooled (DH) piping connection sizes, inches

Water Cooled Models 60 Hz (50 Hz)	A (OD Cu)	B (OD Cu)	C (NPT Male)	D (OD Cu)	E (NPT Male)	F (OD Cu)
DH086W (DH086W)	1-5/8	1-5/8	1/2	5/8	1/2	5/8
DH127W (DH128W)						
DH138W (DH143W)						
DH219W (DH219W)	2-1/8	2-1/8	3/4	7/8	3/4	7/8
DH267W (DH267W)						
DH315W (DH315W)			NA	NA	NA	NA
DH412W (DH412W)						

Figure 34 Upflow water cooled (VH) piping connections

UNIT CONNECTION LOCATIONS

Piping stubbed out inside unit end compartment for field connection through 3 1/2" x 12 1/2" (89 x 318mm) opening as shown. Piping is recessed inside the unit and not flush as indicated. Piping may also exit through bottom of end compartment by field cutting an opening in a suitable location (except bottom return air units).

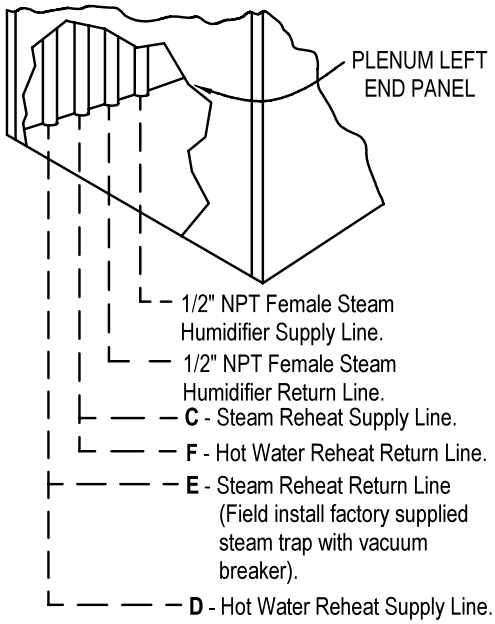

1" (25.4mm) REAR PANEL
7/8" (22.2mm)
3 1/2" (89mm)
A - Condenser Water Return Line.
B - Condenser Water Supply Line.
1/4" OD CU Humidifier Water Supply Line.
3/4" NPT Condensate Drain. Field pitch a min. of 1/8" (3.2mm) per ft. (305mm). Do not install an external trap.
12 1/2" (318mm)
4 5/8" (117mm)
Install field piping through factory-supplied cover plate (not shown for clarity). Seal around all piping penetrations.
Unit Left End Panel

NOTE: Install all piping per local codes.

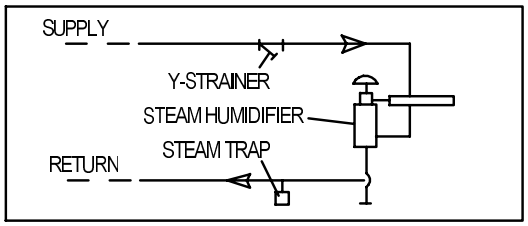
See Figure 37 for piping connecton sizes.

PLENUM CONNECTION LOCATIONS

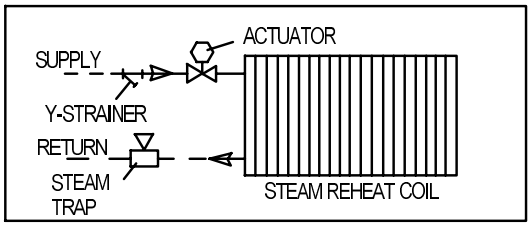
For seperate steam or hot water plenum UPFLOW (VH) units, piping may exit through bottom, top or sides by field cutting an opening in a suitable location.


PLENUM LEFT END PANEL
1/2" NPT Female Steam Humidifier Supply Line.
1/2" NPT Female Steam Humidifier Return Line.
C - Steam Reheat Supply Line.
F - Hot Water Reheat Return Line.
E - Steam Reheat Return Line (Field install factory supplied steam trap with vacuum breaker).
D - Hot Water Reheat Supply Line.

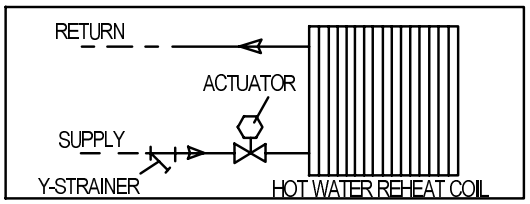
OPTIONAL PLENUM REHEAT SCHEMATICS



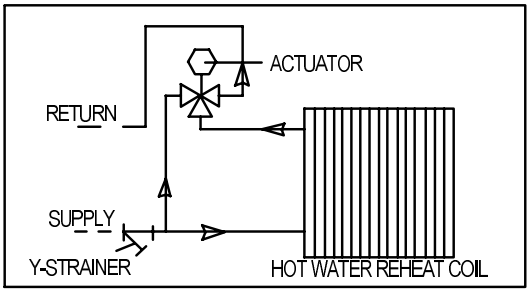
Optional Steam Humidifier



Optional Steam Reheat



Optional Hot Water Reheat (2-Way Valve)



Optional Hot Water Reheat (3-Way Valve)

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Table 37 Factory-provided piping connection sizes, inches, upflow water cooled (VH)

Water Cooled Models		A	B	C	D	E	F
50 Hz	60 Hz	OD Cu	OD Cu	NPT FEMALE	OD Cu	NPT FEMALE	OD Cu
VH-086W	VH-086W	1-5/8	1-5/8	1/2	5/8	1/2	5/8
VH-128W	VH-127W	1-5/8	1-5/8	1/2	5/8	1/2	5/8
VH-143W	VH-138W	1-5/8	1-5/8	1/2	5/8	1/2	5/8
VH-219W	VH-219W	2-1/8	2-1/8	3/4	7/8	3/4	7/8
VH-267W	VH-267W	2-1/8	2-1/8	3/4	7/8	3/4	7/8
VH-315W	VH-315W	2-1/8	2-1/8	NA	NA	NA	NA
VH-412W	VH-412W	2-1/8	2-1/8	NA	NA	NA	NA

NOTES

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